

ENGLISH, LOGIC AND SYNTAX

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SURVEY.

This paper presents the results of research undertaken in order to examine two major subjects in the field of syntactic theory with application to English.

The one subject concerns problems of procedure which have arisen from recent publications in analysing and presenting the syntax of English and of other natural languages. The other concerns the relationship of certain artificial languages of symbolic logic with the syntax of English, and ensuing general implications concerning the nature of the artificial languages.

Both studies were undertaken with the aim of clarifying procedures for the classification of morphemes into class variables and constants, and of clarifying formation and transformation rules which can be applied to them. It is hoped that the results will provide not only knowledge of the structure of English, but some information upon syntactic theory in general. It is also hoped that they will provide some preliminary resolution of problems in the development of a calculus of English for machine use.

It should be understood, however, that stress has been placed upon informative or referential statement and that emotive aspects of language use have been set aside. Thus all discussion

of equivalence of meaning concerns referential material only. Again, sound features have been set aside and emphasis laid upon written material. Justification for this will be made.

I:i The two subjects which constitute the field of investigation have been treated through the works of particular authors, first taking those which concern the syntax of English, and then those which concern languages of symbolic logic.

Works by Harris on natural language have been chosen because of his significant historical position in presenting methods of structural analysis. He has presented the most important approach in English syntax study since Jespersen and Bloomfield. Fries has been selected to accompany him because "The Structure of English" foreshadows Harris' methods, and because it also introduces some problems of meaning in syntax which before and after Harris' first work on distributional procedures have plagued linguistic research. Although Fries' meaning analysis is not of the same stature as Jespersen's his book can be used to arouse important discussion.

The value of the studies made by Harris is considerable, but in order to confine the paper to possible resolution of existing problems, points of criticism have received the lion's share of treatment. This last remark also applies to the lesser work of Fries. Our view of this paper as a whole is largely that it is a refinement

of basic ideas from Harris and symbolic logic, particularly Carnap.

Criticism of the two linguists is based primarily upon their own theories, and a knowledge of the works referred to is required. In addition, the syntax notation which we have used in the following chapters requires some small attention. (See 1.1)

I:ii In both Fries and Harris some major problems of formal analysis which require resolution may be treated. Firstly, there has been a certain amount of confusion in the setting up of classes. A precise method is required because if any member does not satisfy the characteristics of a class, any formation rules which operate on the classes and are to hold for all values, will immediately be invalid. It is claimed that for English, study of words according to the bound forms they take, must be separated from the study of words in positional or distributional relationship with other words. A confusion of the two will lead to the establishment of classes whose defining characteristics are not clearly limited and whose members do not all have the same features. Again, the necessity to give exact specification of the environmental limits which characterize the classes needs to be stressed. This has not always been done.

Such theory is a direct result of criticism upon the establishment of classes in Harris and Fries, and may be found useful for more languages than English (e.g., for the Indo-European group).

Secondly, while Harris does not give any special attention to constants, Fries offers some doubtful opinions. But the definition of a logical constant is fundamentally required in order to be able to separate a syntactic or logical element from a semantic one, that is, from a value of a class variable which is part of the object language and does not belong to syntax at all. It is hoped that a useful definition has been supplied as a result of study in symbolic logic, particularly Carnap, and as a result of theory presented in "Axiomatic Syntax" by F.W. Harwood. ¹

If so, it will be helpful in the analysis of both artificial and natural languages. For example, it will enable a definition of what transformations for a language are to be considered syntactic, and what semantic, a feature which has not always been clear.

I:iii It is evident that the classification of morphemes and of words in this paper is based on distributional criteria. There is no desire, however, to negate the value of meaning studies. But it is held they should not arise in English as initial matters. In the extreme case, to draw on meaning alone as a characteristic of a class is to say that a meaning exists in a language where there is no form either of sound or writing correlated with it as its sign.

The work of Harris and others has been remarkable in the impetus given to purely formal studies. While it will be seen that with formal units consisting of morpheme class sequences, Harris has allowed the establishment of units which have no meaning significance

to an individual at all, and which therefore do not represent how a language is used, it is also true that objections to other arbitrary features of "Methods in Structural Linguistics" can be dismissed. (See "Phoneme to Morpheme" and later sections of this paper on establishment of word classes.) The sequential problems do not invalidate distributional method. Harris has done much in helping to show that if syntax meanings are to be clear, we must state the forms that carry them.

I:iv Another major problem concerns the establishment of formation rules. Once the bound form classes and the constants of English have been given, inspection of the sentences of the language will provide rules for their arrangements. Rules may be given for the generation of sentences as a whole unit, or they may be given for the sentences as broken up into units usually called immediate constituents. Fries and Harris have both chosen methods comparable with the second. Fries examines structural patterns of sentences, 'subjects,' 'objects,' 'modifiers,' etc.; Harris presents a series of rules for the substitution of word classes by sequences of word classes and vice versa. (See Chapter 10).

However, the rules which they supply are not accurate, those of Fries being rather loose and inadequate, and those of Harris being deficient in rigorous refinement of formal analysis. For example, Harris incorrectly allows a syntactic sequence to occur where a class

occurs and generates invalidity because the class does not always take the same environments as the sequence. The eradication of such errors is an important feature of the use of the units which result from IC transformation rules. The eradication becomes so complicated in Harris that another method of stating the sequence substitutions is preferable.

One of the most important ideas for the correct statement of formation rules is presented in "Axiomatic Syntax" by F.W. Harwood,¹ where it is said that syntactic symbols should be numbered serially for each sentence form. Development of this theory will show that the treatment of sentences as arrangements of immediate constituents is not necessary, though it may at times be more convenient. We may compare this point of view with the claim that the transformation rule of substitution in Carnap's "Logical Syntax of Language" may be altered to become a formation rule.² In other words, because substitution procedures permit us to generate new sentence forms from old, allowing, for example, sequences of symbols to occur where previously only one occurred, we may treat the rule of substitution as a form of immediate constituent analysis, which in turn may be discarded in favour of formation rules which generate sentences directly from the syntactic symbols without putting them into units first.

I:v The statement of the IC's of English has been a problem for some considerable time. It is claimed here that a basic approach to a resolution may be gained through the analysis of syntactic transformation rules. These rules supply a statement of what formulas the users of a language consider to have the same referential content, and consequently involve 'meaning' as well as positional or formal analysis. They will show what sequences of symbols can never be broken apart, but which must be treated as single IC units in order to have transformation equivalences, or implications. A second basic approach comes with the study of the possible occurrence of sentence boundaries. An IC is any sequence which cannot be broken apart by the use of the period. This analysis does not involve meaning material, and it is interesting that the units so established appear to link with those found from transformations.

Study of Harris will show that a distributional analysis of sentences, without considering transformations and boundaries, allows an arbitrary analysis of IC's. Consequently, the statement of the formation rules for English when IC's are used, may also be given in a variety of ways. If an investigation of transformation rules and sentence boundaries is made, the IC's which people actually use might be more closely approximated. As a result, the arbitrary assignment of meaning values to the units might also be overcome.

I:vi As a result of study both on the authors above and on logical authors, there has been an attempt to provide a guide to the analysis and presentation of English syntax which may also have bearing on other languages. Starting from bound form classes, formation rules concerning the positional arrangements of the words as free forms in combination with the bound forms they take may proceed. (Such a study would compare with Fries' analysis of the 'positions' words may enter in test frames, though here, we would insist on the examination of more sentences than the ones he gives). Then transformation rules may be supplied which provide IC's and offer some opportunity for assignment of meanings to the IC's. This principle of transformation rules providing a way of defining meanings for syntactic units is drawn directly from Carnap's theory in "The Logical Syntax of Language." ²

II. The second subject, concerning the relationship of certain languages of symbolic logic with the syntax of English, has been approached from three different angles.

II:i Some logicians and linguists have made claims that symbolic logic can offer a calculus by which natural language should be measured, and thus a representation of English syntax. Examination of this has been centred upon Reichenbach's treatment of conversational language in "Elements of Symbolic Logic,"³ with some further work

on Carnap's "The Logical Syntax of Language."² The languages of both authors show that the claims are not true.

One major reason for the opinion is that the symbols of the systems examined represent both syntactic and semantic features of English. In other words, semantic features of the object language of English are made formal in the artificial systems. Therefore the systems must be considered different languages from English, because its semantic values now become indispensable positional features of their formation rules, and may be considered comparable to grammatical categories. English has its own syntax, its own logic.

Another major reason is that though there is an attempt to formalize certain features of English syntax, as may be seen by the examination of the tests we are expected to use when attempting to formalize parts of sentences as arguments, functions, or higher functions, for example, the forms given are inadequate for presenting the diversity of English sentence types. In the calculus of the one and multi place and higher functions the forms act as a frame into which all English sentence types are classified. This means that they have multiple syntactic interpretations, and the forms themselves do not tell us which one to choose. A very important consequence follows. The forms of the symbolic system are incomprehensible and useless, unless we first know how to select an interpretation for them. In fact, it is necessary to know what is the English sentence form that

is formalized, in order to understand the formula.

This^{is} true also because semantic material is included and formalized ambiguously. It is an objectionable characteristic of the logic formulas provided by Reichenbach, Carnap and others that individual values of the logical class variables of English, that is the object terms of English, are not only kept in the metalanguage, but kept there with multiple interpretations.

It is hoped that detail in analysis of Reichenbach and of Carnap will illustrate the far-reaching extent of confusion in logical procedures in relation to natural language structure. Not only is there a one - many relationship as above, but there also can be a many - one. Thus two or more formulas can be found for one type of English sequence.

At another time, incidentally, it may even be found that a formula of logic in Reichenbach has no correspondence in English, and that it is yet held to represent an English syntactic expression. But far more frequent and certainly more important, is the discovery that the definitions of the terms of the functional calculi are very often not precise enough to enable decision on what English syntactic features are to satisfy them. Again, the separation of one English syntax unit into two logical ones provides further criticism.

This state of affairs appears to be largely due to the fact that logicians, while being aware of syntactic forms bearing upon

their analysis have never adequately dealt with them. This is because they have begun with meaning concepts and followed with the attempt to find expressions which contain them. Thus symbols and expressions can sometimes be defined by meaning concepts only, and at others by features of English syntax. Many logical discussions seem to push English into formal systems by way of only loose rules of analysis. The definitions of argument, function and higher function, can tend at times to impose meanings which may not always necessarily apply. Logicians can also show a tendency to select only those features of English which satisfy their particular demands for an artificial language and condemn others which do not. In this they fail to recognize the internal validity of the natural language.

II:ii Because it became clear during work on II:i that the syntax of functional logic demands an understanding of English or of another natural language for its comprehension, we approached it with a view to establishing its dependence upon the structure of English. (Support for this comes independently from the history of the development of logic.⁴)

A conclusion was reached that functional logic may generally be considered a kind of superstructure erected upon a natural language after both semantic and syntactic knowledge has been discovered. It is therefore translational in nature and not structural, because English information is simply re-expressed. If it were representative

of form or structure, then it would contain syntactic elements only.

Its dependence upon a knowledge of the syntax of English (or another natural language) can hold whether we consider it with a natural language interpretation or not. Even if functional logic is not used with a natural language supplying its object terms the claim can still be true. For example, it can be seen that the values in use of the comma, brackets and symbol order can change, and that these supposedly constant symbols and their arrangements can have in fact a variable nature. There must be some means of deciding how they are to be interpreted and this means is at present provided through a knowledge of a natural language syntax. Otherwise it appears that various individual words (or mathematical concepts for example) have to be held constant in the metalanguage so that their syntactic nature can point out the values of the constants just mentioned.⁵ (See 20.31).

In fact, however, the functional languages have been used a great deal as formalizations of information provided in natural language expressions. So there is justification for the view that a full statement of the syntax of a natural language could profitably replace existing logical systems as a basic frame for formal deduction. Thus we would introduce present logical concepts into the syntax frame. If symbolic logic is ever a formalization of natural language, then the syntax of natural language will also provide a formalization which enables semantic elements to enter when required, and it may replace the artificial language for deductive purposes.

Distributional analysis can provide the variables and constants of the language and formation rules will follow. Transformation rules of a syntactic kind can then be given and calculus style deduction proceed. But it may be convenient to turn from a syntactic calculus in order to make deductions from individual values of variables. Those semantic values of English which feature fundamentally in logic may be held constant and used within the syntax calculus (for example $\underline{+}$, $\underline{\times}$, $\underline{\vee}$, etc.)

Thus the simple calculus of functions and the class calculus may be considered sub-units of an English syntax where all except the semantic values which are made constant is still expressed through the distributional symbols of English. The sub-units will provide the same results as Russellian logic systems, but will not use all their symbols. In the calculus of simple functions for example, the symbol $\underline{\exists}$ will be retained as a constant which is not a feature of English syntax; but expressions using \underline{f} and \underline{x} will be excluded because they may be replaced by those combinations of positional class variables and constants which they represent, or by values of such classes if necessary to represent certain English expressions considered important in logic.

Other sub-units, keeping other values of variables constant, can be set up. The calculus of modalities for example could be set up within distributional syntax. According to what object language terms are kept constant, a variety of deductive systems is possible,

greater than the variety now existing in symbolic logic. Consider a calculus using various prepositions as constants. Various deductions in scientific subjects can also be made by the use of sub-units which include empiric laws. It is suggested that these would be preferable to instances of the use of Russellian logic such as Woodger's formulation of a calculus for biology.

Rosser⁶ has pointed out that deductive thinking proceeds intuitively through the use of natural language regardless of any of the usual symbolic logic languages. It is suggested in the present paper that such thinking automatically uses basic formal structure as part of its deductive equipment, just as an ordinary language speaker follows prescribed rules. If the structure can be defined and made axiomatic, then the processes of reasoning may perhaps be made simpler because forms and transforms are easier to recognize. Reichenbach claims for logic that it does make deductive processes easier. But unless functional logic reconstitutes its definitions of symbols so that what structure of the natural language each formalizes is clear and precise, this does not appear quite true.

This is not to say that an artificial language may not be constructed which dispenses with natural language syntax completely. It is possible that a system could be established using so many individual values of natural language variables, and ignoring so many natural language constants, that natural language syntax does not

bear upon it. It would be entirely independent.

What has been said on the dependence of the functional languages upon a knowledge of English syntax applies also to Carnap's co-ordinate languages I and II.² Even in the arithmetical formalization of the syntax of Language I, dependence can be found. Language I is not formalized within itself. But the co-ordinate languages appear to be too complex in replacing natural language for purposes of communication in any case.

II:iii The third approach centred upon what use could be made of certain principles concerning the structure of languages which are to be found in work upon symbolic logic. Some indication of the results of this study which have been found useful for the analysis of English has already been given in the first section.⁷ It is hoped that further understanding of the nature of syntax as opposed to semantic or factual truth, and the definition of logical or syntactic terms as opposed to semantic ones, has been given. Thus the introduction of semantic transformations within a framework of syntactic ones, can be compared with the introduction of empiric laws into a deductive calculus. These matters are of considerable importance.

The whole section on the statement of the logical symbols of English in Reichenbach's work needs restating in the light of the definition now supplied of a logical symbol. Similar work needs to be done for the artificial languages as in Carnap etc. A meaning of

a syntactic structure can be similar to a combination of values of certain class variables. It is then easy to confuse syntactic and synthetic material as happens with Reichenbach and others.

The division of logical terms into semantic, pragmatic and syntactic appears to be of little use, and we would prefer to say that logical terms may be approached in two different ways, the emotive and the referential.⁸

Theory about transformation rules has been supplied with suggestions for use in discovering IC's. In addition, it is held that these rules do not necessarily, as Carnap has held, determine the logical symbols of a language. They can be discovered within the formation rules alone. Finally, further emphasis has been given to the need for positional numbering of syntactic elements in order to state formation rules.

As a result of (3) it becomes clear that logic and syntax are not identical terms, and that some differences with Carnap about the nature of logical variables and constants arise.

II:iv The detailed investigations of particular works, especially Reichenbach's, demand that we measure them against a background analysis of English similar to the one suggested in 1.1 and 23.52. A knowledge of English syntax as discovered by linguistic experts is assumed.

Some of the criticism made concerning the imprecise use of symbols and formulas is specific to Reichenbach's language, but on the whole, general application can be made to the calculi of both simple and higher functions.

Because of the one - many, many - one nature of functional formalization of English, it is not considered that it would be useful for machine use. Invalidity and incomprehensibility would follow. Nevertheless, Reichenbach must be considered a pioneer in attempting to express the relationship between functional logic and English grammar.¹

¹ Harwood, F.W., "Axiomatic Syntax," Language, 31(1955), pages 409 - 413.

² Carnap, Rudolf, The Logical Syntax of Language, (London, Kegan Paul, Trench, Trubner and Co., 1937).

³ Reichenbach, Hans, Elements of Symbolic Logic, (New York, MacMillan, 1947).

⁴ See briefly: Lewis, C.I., and Langford, C.H., Symbolic Logic, (New York, The Century Co., 1932), Introduction.

⁵ It will be seen from the work of Rosser, J. Barkley, Logic for Mathematicians, (New York, McGraw-Hill, 1953) that a logical calculus could be made independent of a natural language. While no full analysis has been made of his language, it yet appears that

the functions and relations are here limited to special kinds, and that every sign for either can be individually defined. Thus, if his language is independent, it is so, because variability has been eliminated by the introduction of rigidity.

- 6 See the work in 5 above, p.9 - p.10.
- 7 These results can be compared with the views as in
 - (a) Bar-Hillel, Y., "Logical Syntax and Semantics," Language, 30(1954) p.230 foll.
 - (b) Chomsky, N., "Logical Syntax and Semantics," Language, 31 (1955), p.36 foll.
- 8 Richards, I.A., and Ogden, C.K., The Meaning of Meaning, (6th ed., London, Kegan Paul, Trench, Trubner and Co., 1944). For opinion about the differentiation between emotive and referential uses of words, see Black, Max, Language and Philosophy, (New York, Cornell University Press, 1949), Chapter IX.
- 9 (a) It may be noticed that although such works as that by Harris, Zellig S., "Co-occurrence and Transformation in Linguistic Structure" Language, 33 (1957) p. 283 foll. and Chomsky, Noam, Syntactic Structures, The Hague, Mouton and Co., 1957) have some bearing upon the natural language sections of this paper, there is no reference to them. This is because the line of research undertaken was begun and virtually completed before their publication. In order to retain individuality, I have deliberately set them aside, but they may be useful for correction or development of some ideas presented.
- (b) I would also like to express my thanks for the help gained from discussions with the supervisor of my research, Mr. F.W. Harwood. Some of the points he made have been written into the body of the text, with or without direct recognition.

PART I.AN INVESTIGATION OF "THE STRUCTURE OF ENGLISH"BY CHARLES CARPENTER FRIES.CHAPTER 1.INTRODUCTION.1.0 Survey

1.01 The fundamental conception at the base of the work done by Fries in "The Structure of English", is that form should provide the means of establishing and differentiating syntactic characteristics. Meaning as a tool of analysis is to be used only in so far as a speaker of a language records whether a particular aspect of meaning is 'same' or 'different' in a given utterance (S.E. p.8.).¹

In this we find agreement with other scholars such as Zellig S. Harris. However, the most serious fault of the book is that formal analysis is not carried far enough, and does not achieve sufficient rigour.

Fries slides into discussions of "structural meaning" which tend to place his work with that of others who stand half way between Jespersen on the one hand, where analysis of syntax is undertaken according to categories of meaning,

and Harris on the other, where distributional analysis provides syntactic information.

The arbitrary nature of some meaning decisions links back to similar error in traditional grammar. In immediate constituent analysis for instance, a meaning unit may be assumed which links together certain morphemes not necessarily considered as a group by the users of a language. Resulting structural systems may then provide an imposition of ideas and forms without proper reflection of the actual syntax.

The development of English structural studies in this century, shows not only a major growth in ideas, but also and incidentally, how easy it is to slip into pre-conceived notions whether of form or meaning. Because of a familiarity through use of the language, strict study of the precise means of conveying information can tend to be obliterated. This is also repeatedly evident in the work of prominent logicians, whose desire to make natural language fit a logical norm has led them into overlooking the formal rules of English itself.

What is needed is a calculus which records the word-order, inflectional, and other formal signs of the terms in the object language, so that it becomes clear firstly, what syntactic rules the language observes, and secondly, for what meaning reasons these rules exist.

It is a contention of this paper that the second ~~features~~ can profitably be approached through the first.

1.02 Distributional studies which discover what free and bound morphemes can occur in what sentences each of a given number of morpheme positions, can provide a strictly disciplined procedure. This record of the number of morpheme positions in each sentence provides several advantages. It gives us a control over the comparison of one sentence with another, so that similarities and differences can be conveniently treated. It enables us to state exactly what individual structures certain word classes enter, and to note how the classes vary in membership according to the different sentence structures in which they appear. It presents a way of observing how structural ambiguity can be eliminated by placing certain logical class and constant symbols in certain positions. It also enables us to realize the difference between the semantic and syntactic or logical uses of words, by testing out substitution possibilities for each numbered position. (See 7.4). Finally, it is useful in recording exactly what changes occur when conversions and transformations are made for the purposes of studying structural meaning equivalences.

Zellig S. Harris in "Methods in Structural Linguistics" does use a system of numbering (p. 353 foll.)², but

its full power is not realized or discussed in major procedural sections. Fries does not use it in his work at all, although a classification of the uses of words demands that individual sentence types be treated as formal frames for the entry of values of classes. Reichenbach's failure to give precisely the forms which define his argument and function classes, could be treated by making use of this practice.

1.03 Syntactic errors then, can be eliminated from Fries' work. However, he places some appropriate emphasis on meaning which is not out of place at the present stage of structural linguistics.

His insistence that form carries meaning, that the two are inseparably united, is of value in view of some recent tendencies to consider meaning as of no importance at all to the descriptive linguist. Although it is true that the linguist must approach structural linguistics with no preconceived notions as to what meanings certain forms may have, and must not limit his analysis by an attempt to push varying forms into a meaning category which may or may not apply, it is also true that once formal analysis has been made, there is legitimate scope for enquiring why these forms exist and what their meaning values are. A most useful way of doing this is to study distributional relationships in sentences where the same

values of variables in different patterns have the same referential content. (See 22.2). The idea of structural meaning can then perhaps be reduced to definitions of what syntactic conversions certain logical classes and constants will take. Eg, $\bar{n}_1 \text{ v + d } \bar{n}_2 = \bar{n}_2 \text{ was v + d by } \bar{n}_1$. However there may be limits to the use of this procedure which are at present uncertain.

In view of these ideas, it is fundamentally correct to take as a principle that the analysis of a language "starts from a description of the formal devices that are present and the patterns that make them significant and arrives at the structural meanings as a result of the analysis". (S.E. p.57). Even though Fries does not always follow the principle in practice, he is far more aware of the necessity to examine further the empirical nature of English than logicians such as Reichenbach.

They tend to overlook the signs that a linguist would attempt to record. Such cases of structural ambiguity as Ship sails today where the formal framework is not fully determined, rightly receive attention from Fries (S.E. p.62). But the fact that it is only certain signals which eliminate other alternative meaning interpretations is not always recognized by Russell, Reichenbach and others.³

Fries aptly points out "We have assumed in our

approach here that the signals of all structural meanings are formal matters that can be described in terms of form and arrangement." (S.E. p.64).

1.04 This leads him into stating structural signals of English by setting up words as parts of speech in formulas. "We should be able, then, to express our descriptions of the patterns that signal structural meanings in terms of formulas with the various parts of speech as the units." (S.E. p.69).

Such a metalanguage demands that each formula must have a consistent interpretation. If there are various interpretations for a single formula, or if there are various mutual formalizations for two or more sentences, then the calculus will become rather useless. Although Fries makes some serious errors in defining the features of his metalanguage, he does get nearer to an interpretable system for English than Reichenbach. Neither, however, is satisfactory.

Fries is to be criticised mostly for the confusion of ideas on how to classify words into parts of speech. There is certainly serious error here. His treatment of function words, and his definition of the sentence can also be refined. The I C analysis and the discussion of basic sentence types are both of only moderate value, because insufficient formal analysis is incorporated.

1.05 However, we may conclude with one very significant remark made in a footnote (S.E. p.56, footnote 3): "The borderline between lexical meanings and structural meanings in a language like English that uses 'function' words is not always sharp and clear..... More important, perhaps, is the fact that meanings which in one language are signalled by patterns of form and arrangement, in another language may depend upon the choice of vocabulary items."

Logicians have not given sufficient attention to these matters when trying to formalize English in terms of logic. Although Fries does not himself achieve a clear separation of syntactic and lexical material, nor think that one is easy, he does provide some introductory hints about logical terms in his treatment of function words. It is essential and possible to find out when a signal is a syntactic element, and when it is a vocabulary item.

It is then possible to set about finding the structural differences between languages. For example, Reichenbach's language apparently demands that any English noun that refers to an existing object, must be split into argument plus function form. Eg. box = ($\exists x$) b(x). No such formal representation of existence is required in English.

Reichenbach also repeatedly takes various other synthetic features of English and names them syntactically in logic without observing the change he has made. One example of this is his treatment of the word implies. In logic this becomes a formal constant, a symbol in the metalanguage, but in English it is one of a series of values of the verb variable and belongs solely to the object language. It is hoped that this claim will be shown valid later by way of comment made on the work of Fries.

1.1 A Syntax Notation.

In order to discuss Fries and the authors to follow it will be useful to have a syntax notation which can be applied in all chapters. It is not considered that the symbols satisfy the definitions of logical classes and constants given later (see 4.3 and 7.4), because methods of analysis to find them have not been used. Objections that some classes and constants have been overlooked could be made, and some of the constants accepted below might be shown to be values of small class variables. Again, the class symbols stand for words and not just single morphemes, and so the regulations for textual examination provided in 7.4 are altered to a slight extent along the lines of 3.1.

The main purpose, however, is to provide a conven-

lent notation which is accurate enough for common English word classes and constants to enable comparison of sentences and authors to be made with some validity. Bound forms involved in word formation, nexus and so on, have been neglected in order to simplify.⁴

Classes

- n : words which combine with the inflections +o, +s, + 's, +s'. (The s symbols cover vowel change with absence of inflection and so on.)
- n̄ : proper names. These usually occur only in the singular or else only in the plural.
- nth : like n, but have a time or place or manner reference. (See Fries S.E. p.180, p.194.)
- n^{sg} : like n, but need not occur with +s or +s'. For example, mass nouns like coal, cheese, etc. which also occur without t in cases where n would demand t.
- n^{pl} : like n, but never occur without +s, and do not occur with +o or + 's. For example, news, clothes.
- All of these classes will be called n indiscriminately where convenient.
- v : words which combine with the inflections +o, +s, +ing, +d, +n, and which are transitive. (Again, the inflection symbols cover variant forms; e.g. +n can be useful in replacing +o when a past participle occurs without inflection.)

$v^b, v^c, v^d,$
 $v^e, v^f, v^g,$
 v^h

sub-classes of y according to Harris' definitions in M.U. p.167.⁵ We make y^b equivalent to the predicative intransitive class 2b noted by Fries in "The Structure of English" (p.135, p.189). The verb to be is excluded.

v + n' : those words which do not occur in the form of v + o, v + s, v + ing and v + d. Eg. hearted, uniformed, etc.

v + ing : have special subdivisions. Eg. those words which take +s and/or +ly.

The y subdivisions will be called y indiscriminately where convenient.

a : words which take +o, +ly. They may also take +er/+est, and be preceded by more, most.

Some words usually called adjectives do not take +ly, eg. young, long, grown. They are included in the adjective class for convenience though they properly require separation. Although some might appear in n positions they are not to be called n because they do not take its range of inflections.

n/a, n/v,
a/v, n/v/a : Those words which take the range of inflections of the classes involved.

- m^1 : I, we, he, she, you, they.
 m^2 : me, us, him, her, you, them, etc.
 m^3 : my, our, his, her, your, their.
 m^4 : mine, ours, his, hers, yours, theirs.
- r : "auxiliaries", not including will.
 p : "prepositions". Careful syntactic sub-division is necessary, but we merely accept Harris' p_b and p_c (M U p. 168) and set up another small class p(ltd) for work on his sentence types.
- p_b : "prepositions" which can occur in the next position after certain v.
 p_c : "prepositions" which are replaced by zero in certain occurrences. Eg. They gave a dog to the children. They gave the children a dog.
- $p(ltd)$: these p_b can combine with certain v and n in such an order as I'll knock your opponent down. (M.U. p. 173).
- The p class will be simply called p where convenient.
- i : "interrogatives". Where, why, when, how, who, whose, which, what. (Supplied by Fries in S.E. p. 167). Note also whom. The words have other uses.

t' : "determiners", which not only occur in the position preceding n , but which can also occupy the position before a verb in order to make a sentence. Eg. Both are on the table.

t : "determiners" which can not precede a verb as t' values do, but which occur in the same place before n .

Both of these last classes will be called t where convenient, and marked singular and plural where required. Thus t^{pl} , t^{sg} . Further classification is demanded, but ignored here until full investigation is made. Eg. this does not occur in the same way as all in all of the men.

c : "conjunctions" which join two finite verb sequences. They include Fries' sequence signals except for moreover, besides and also: however, yet, nevertheless, likewise, otherwise, therefore, thus, consequently, accordingly, while, if, when, before, since. (S.E. p.250). Note also although, why, because, though.

c' : "conjunctions" which can occur between two classes of words of the same kind, as well as between full finite verb sequences in the same way as c . Eg. and, but, or, then.

- c : "conjunctions" which can occur directly after n to make phrases occurring at the end or beginning of Z. E.g. however, therefore.
- d : "adverbs". They can occur in the place of a + ly before a + o. Eg. very, quite, too, fairly, rather, still. (See Fries S.E. pp. 12-3).
- d^s : "adverbs" which act as sequence signals and can occur where a + ly occurs at the beginning of a sentence or after or before v. Eg. earlier, later, afterwards, then, meantime, meanwhile, before, since. (See Fries S.E. p. 249 foll.)
- We include also moreover, besides and also.

It can easily be found that the non-inflected classes are not accurately defined, and that according to 7.4 their values need re-sorting. For instance, we need to collect those words which appear in more than one of the existing classes, and re-group according to exactly where each one occurs, in order to satisfy the requirement that if in any class any morpheme or group of morphemes is found to have one or more exclusive sentence circumstances, it is to be separated from the already established class. Thus before is to be separated from c because it occurs in d^s, and is to be separated from d^s because it occurs in c.

We need to put it in a new class. Similarly, the other uses of values of the existing classes need to be examined. But the present classification is accepted because the same errors would only occur again in another system which does not draw on an extensive examination of texts.

Constants (Tentative)

<u>BE</u>)		<u>more</u>
<u>MAKE</u>)	Each form of	<u>most</u>
<u>DO</u>)	these verbs	<u>of</u>
<u>HAVE</u>)		<u>will</u>
		<u>such</u>
		<u>just</u>
<u>that</u>		<u>so</u>
<u>there</u>		<u>+self</u>
<u>it</u>		<u>+s</u>
<u>its</u>		<u>+ 's</u>
<u>not</u>		<u>+s'</u>
<u>as</u>		<u>+ing</u>
<u>than</u>		<u>+d</u>
<u>to</u>		<u>+n</u>

Numerical subscripts will be used in the notation to denote where necessary that a value of a class is not repeated. Thus \underline{n}_1 , \underline{n}_2 , \underline{v}_1 , \underline{v}_2 , etc.

\underline{Z} is a special symbol signifying that class of sequences which contain a finite verb or a finite verb phrase demanded by a full sentence.

- ¹ Fries, Charles Carpenter, The Structure of English, (New York, Harcourt Brace and Co., 1952). "S.E." will be used throughout for convenient reference.
- ² Harris, Zellig S., Methods in Structural Linguistics, (Chicago, University of Chicago Press, 1951).

³ See for example: (a) Quine, W.V.O., Methods of Logic, (London, Routledge and Kegan Paul, 1952), p.xv.

(b) Russell, Bertrand, An Inquiry into Meaning and Truth, (London, G. Allen and Unwin, 1940). Various passages can be extracted.

⁴ (a) For word formation see Harwood, F.W., and Wright, Alison M., "Statistical Study of English Word Formation", Language, 32 (1956), p.260 foll.

(b) For more information on word classes, for example the n and v classes, and the personal pronouns, see Harwood, F.W. and Wright, Alison M., "Inflections of the English Verb, Noun and Pronoun", Tasmanian Education, IX (1954), p.68 foll. See also Harwood, F.W., "English Word Classes", Tasmanian Education, X (1955). References to Harris and Fries are given at appropriate points and acknowledgement should be made of some details included from unpublished material by F.W. Harwood. Other details have resulted from personal but only preliminary research.

(c) to, although it is called an inflection, is only a recording device in this paper, and is not to be counted as a morpheme position. See 7.44 and 23.12.

(d) Underlining of all metalanguage terms throughout the paper is largely for the purpose of differentiating them from the text. However, Harris' lettering has not been underlined in order to keep to his style.

⁵ M.U. stands for "from Morpheme to Utterance" by Harris, 2nd ed., Language, 22, (1946) p 76 foll.

CHAPTER 2.

SENTENCES

2.0 Introduction.

The work done by Fries on the sentence shows a handling of new concepts, but also some error resulting from difficulties in doing so.

While offering current views on its definition, he fails to stress that the sentence must be a form capable of eliciting a response; while recognizing both minimum and expanded sentence types, he fails to identify the minimum kind, and does not give sufficient theoretical reference to the sentence building importance of function words within them.

Nevertheless, he has done very useful work in pointing out that sentence forms may be classified according to the types of response which follow them; and he has given some interesting comments on how to treat the meaning of a sentence, disagreement though there might be.

In all, the treatment of the sentence provides a suitable point at which to begin, because it enables the framework (or system of sentences as formulaic patterns) in which word classes as variables occur, to be developed in a preliminary way.

2.1 Sentence Boundary and Definition.

2.11 The attacks which are made by Fries upon older definitions of the sentence show their inadequacy, and he provides a pertinent starting point for his own theory and that presented here, by taking Bloomfield's definition. (S.E. p.21).

"....each sentence is an independent linguistic form not included by virtue of any grammatical construction in any larger linguistic form."¹

But his claim that he provides a means of finding the sentences in a given text whereas Bloomfield does not, cannot be fully supported. (S.E. p. 21 foll., p.29).

Though the theory of seeking recurrent partials (S.E. p.36 foll.) can be developed directly from Bloomfield, it is not complete as a method.

In order to show this, the definition quoted above may perhaps be amplified by saying that a sentence is an independent form capable of eliciting a response. Thus we may identify a sentence by seeing whether certain arrangements of word classes and constants can make a communication to a person, when individual members of the word classes are used. The person should not have to enquire for a further structural sequence in order to understand what the arrangements mean.

For example, if someone says, What is that noise?

and the reply is The barking dog (t v+ing n+o) or The dog barking (t.n+o v+ing) these two last sequences form complete units of communication and may arouse a response from a listener. It is necessary to consider all formal characteristics when listing sentence types, and consequently the ones above would have to be differentiated from others where there is no previous utterance. (See S.E. p.165 for remarks relative to this.)

One of the advantages of the definition of the sentence given, is that such expressions as those which are formally complete when used as responses to certain forms, but which are not independent when used as initial utterances, can be considered sentences in the response positions. Another and more important one, is that it excludes the possibility of such repeatedly occurring units as the barking dog, being made diagnostic of sentences in all sequences, because they have at times occurred as independent units. It is hard to follow how Fries' theory of seeking recurrent partials, if not his actual work on sentences, overcomes this possibility. (S.E.pp.39-40). Even a study of intonation in dependent and independent units would not necessarily exclude it. (See also S.E. p.26, p.36, p.285).

2.12 These remarks and those to follow, primarily concern written language, and not spoken. Intonation patterns, for instance, are not given very much attention, even though it is not denied that intonation is a very important formal feature that may be indicated by punctuation and etc. The reason for stress on written language, not only in this chapter but in the whole of the thesis, is largely because of limitation to the solution of some problems in written language which are very important if machine handling of language is to be achieved. In addition written language does not necessarily provide substitutes for the formal sound features. Thus Vandenburg reports open forum may be non-ambiguous in spoken language as Sledd² points out. But in written language it remains so. However, there is not full agreement with Sledd that

"Bluntly, the neglect of phonology made it certain that Fries would have difficulty in defining the sentence, that some of his form-classes would be hopelessly heterogeneous, that his discussion of certain structures such as modification would be misleading, and that he would invite the very confusion of speech with writing which he exhorts his readers to avoid."
(p.339).²

A great deal can be done without intonation, stress, and other sound studies. In any case, we must make some approach to written language pending a full investigation

of just what sound signals are and are not indicated in written material.

2.13 The old concept of a sentence as a complete unit of thought, may be replaced by the concept of it as a complete unit of form. For example, in discussion of what have been called abbreviated sentences, it may be held that such sequences of word classes are intelligible to the hearer and formally complete, because form may be supplied ^{mentally} by the hearer in order to make a sequence which is accepted as one of the sentences of the language. Eg. Train schedule altered (The train schedule has been altered). Consequently, although for instance Fries maintains that additional words are not 'understood' in abbreviated sequences, it is held by us that if these sequences are formally intelligible to a listener, then they may always be expanded into a form which contains the conventional structure. The important feature to be observed here, is that their forms are capable of carrying lexical content as they individually occur. Others such as t a + o a + o are not.

Formal definition of sentences is necessary in English, but these definitions will not be absolute. In a long, running sequence as Fries shows (S.E.pp.10-11), the division of the words into sentences allows a wide choice. Differences in punctuation are permitted in English, and very often it is of little formal importance whether we use

a comma, a colon, a semi-colon or a stop. Here again, it may be noted that form has meaning, and that differences in punctuation allow for differences in emphasis as the writer wishes. So the old idea of units of thought in sentences, has some value after all. A full stop is the symbol of a more decisive break in the flow of words than a comma, for example. If a person uses many periods as opposed to another who uses only one for the same sequence of words, it may be held that he wishes to mark off his flow of speech, the passage of his thought, with a different emphasis. There is no formal obstruction to this, and it is a feature of English that form is sufficiently flexible through the uses of comma, period etc., to allow for choice in style. Not only formal considerations, then, but those of meaning also, will determine the writer's use of sentence type.

If we wanted to build a machine that would operate on a set of sentences, our rules for forming these sentences could be based on the use of the period, to the exclusion of the comma in certain circumstances, and the complete exclusion of the colon and semi-colon. This would lower the number of rules required otherwise.

The signals of a sentence, i.e. the formal rules for the construction of a sentence are not fixed, but imposed with some element of choice. This of course holds for spoken as well as written language.

2.2 Method of Identification of Minimum and Expanded Sentences.

2.21 It is said in a footnote (S.E. p.36, footnote 12) that intonation and pause patterns were found unfruitful in trying to establish the forms of English sentences. So,

"....we needed to find a workable method of identifying and extracting from the recorded conversations the single free utterances that occurred there - workable in the sense that there should be no uncertainty in the criteria used and that others taking the same set of criteria would arrive at the same results." (S.E. p.36.)

This is not in agreement with previous remarks here, nor with Fries' own comment on the possibility of alternative sentence subdivisions in a paragraph. (S.E. p.10). It is possible to arrive at different analyses, in some sequences at least. Form does not prevent other arrangements, for example those using commas. However, since we hold that commas as well as stops, may mark off Fries' minimum free utterances, we have in one sense, got a single analysis. It is punctuation which provides an element of choice. The only way to get a completely unique analysis would be to mark off as a sentence every single utterance capable of being used independently, and then note the

expansions which could never be used on their own.³

2.22 A more important problem in the book concerns the lack of clarity in the means of establishing a minimum free utterance in the first place. A passage (S.E. p.39) describes the method used:

" by a long process of comparing each utterance unit with many of the others, seeking recurrent partials, it was possible to separate those that consisted of single free utterances from those that consisted of sequences of free utterances."

It also said (S.E. p.40) that the same process was used to find the forms which built expanded free utterances from minimum ones.

These remarks complete the description of the basis of analysis. As a theory, it is not adequate to show why, for example, single word expressions such as Gone!, Here!, Go! and etc. might not be considered minimum, since they occur as independent expressions as well as recurrent partials.

As 2.11 has claimed, such a method can not extract free utterances without reference to whether the forms are capable of eliciting a response. There are many occurrences of word arrangements in English which do not form sentences. Even if a frequency study is used, it is inadequate when used alone.

Although Fries does not say so in the quote above, he obviously must mean the examination to turn on the study of those recurrent partials which can stand independently of other forms. In other sections he is also aware that certain expressions, such as those which are sentences only in response utterances, can not be defined as sentences unless we also consider under what conditions they are capable of eliciting a response. But neither of these points is made sufficiently clear in the basic ideas of analysis. (Cf. S.E. p.40-41)

2.23 Turning now to the actual minimum sentence types given, we may find some confusion in the lists of expressions which are held to satisfy this heading. We are told on the one hand (S.E. p.88, pp.105-6), that function words occur only infrequently in minimum free sentences such as those used in finding the parts of speech in Chapter V. Function words, it is said, belong primarily to expanded sentences. On the other hand, we find a number of these words in the sentence patterns of Chapter VIII, which is said (S.E. pp.40-1) to deal with basic sentence types and minimum free sentences of both the situation and response kind. So exactly what to permit and what not to permit as minimum remains obscure. (Perhaps the function words in questions at least, help to provide minimum patterns. See S.E. p.172).

Another important obscurity concerns the fact that while Chapter V uses the four parts of speech in minimum sentences, Chapter VIII (e.g. S.E. p.144, p.148, p.172) and other parts of the book (e.g. S.E. p.88, pp.105-6, p.263) suggest minimum sentences should be described in terms of classes 1 and 2. Why the structural frames in Chapter V are not considered expanded, is exceedingly obscure, if n - y provides the single basic and necessary pattern in statements. (Did Fries find, perhaps, three major verb types which remain unstated, but which yet provide him with basic frames?)

Perhaps a statistical approach was taken in treating the material. "The important fact here is that the four parts of speech indicated above account for practically all the positions in these minimum free utterances" (i.e. situation utterance units). (S.E. p.88). Some basis for the view that the three structural frames of Chapter V are minimum and opposed to sentences using function words, may have been found in the statistical results of S.E. pp.104-6. Nevertheless, although Fries again holds that all utterances consisted primarily of the arrangements of classes 1 to 4, it must also be noted that function words formed one third of the total mass of the material when repetitions were included (S.E. p.86).

Why then, should these function words be excluded so

much from minimum free sentences? Why cannot such a sentence as n v p t n be considered minimum when n v there (frame C) is considered so? (For both p and there (a member of class 4) are treated as modifiers). What are the upper and lower limits of the term?

In any case it is very difficult to believe that, as stated (S.E. p.88), function words occurred so little in situation utterance units, that is, the units used to extract minimum sentences. Examples given (S.E.pp.38-9) certainly do not suggest the claim is correct.

2.2⁴ Finally, a full statement of the most common sentence types would probably agree largely with Fries' selection, though there might be some difference of opinion as to what is to be called minimum. The last matter is really one of what sentences should be held as an initial set, and supplied with formation rules in order to generate the rest.⁴ In this there may be an element of choice, though it is likely that arrangements of n - v, with essential function words such as the, should be considered minimum in English, for both classes are necessary to have a sentence at all. Even in abbreviated or sub-minimum sentences, if one or both classes are missing, they may be supplied.

On the other hand, arrangements which include more than n - v, may be considered common sentence types if they are found frequently enough.

2.3 Situation and Response Units.

2.31 As a means of classifying the sentences of English, Fries again draws upon Bloomfield's theories, this time about language as a means of communication between two nervous systems, and as a result divides sentences into those which occur without previous utterance, i.e. situation units, and those which follow utterance, i.e. response units (Chapter III). While there is basic agreement with the division thus made, some comment may be of advantage.

Firstly, one may observe that the distinction between situation and response utterances is not so much psychological as formal, the feature which Fries discusses most. The real difference between situation and response utterances is that for the response utterance, language has been one stimulus among others, and that it produces characteristic language effects absent from utterances without previous speech. Verbal responses to both situation and speech stimuli are obviously dependent upon a totality of complicated psychological factors, which the diagram and comments on the working of language (S.E. p.34) permit for consideration. (This is true for those who hold a mechanistic view of the activity of the human mind, and for those who like the present writer do not). On the formal level the speech act does elicit one of a range of forms in response, but the semantic values of the form chosen, why one form is chosen in preference to another, for example,

are matters not solely dependent on the original speech act.

With this in mind we may understand the following statement. "We can proceed on the assumption that if a particular response regularly occurs after a speech form or a language pattern then this pattern or form 'means' this response" (S.E. p.36). (It is necessary first to accept that a 'response' consists of both formal and lexical elements. Fries refers to formal elements in the original utterance, but it is not certain whether he refers to both in the response. However, we will treat an utterance and a response as a unit of both for the time being.)

If it is held that an utterance 'means' a certain response or certain responses, it is important to realize that the situation + psychological factors + speech, i.e. all the stimuli handled by the hearer, are assigned to its meaning. When the response is called the 'meaning' of the original utterance, the original utterance stimulus must be given the 'meanings' of the stimuli other than language as well. It is not certain whether this is a wise practice. It seems that the term 'meaning' is a rather confusing one. For example, even though many might say that Yes I have is the meaning of Have you been? because it is a regular response, they would not say that Have you been? is the meaning of Yes I have, whereas in the ~~referential~~ definitions of words a puppy means a young dog and a young dog means

a puppy. Perhaps implies in the sentence cases and equals in the word cases would be better.

It is true that the purely linguistic result of an utterance, i.e. its response, may be so common as to warrant a definition of the meaning of the original utterance in terms of the other, while realizing the nature of what is being done. But we would still have to permit that on the semantic level sentences allow for the use of a wide range of lexical items in the comparatively limited number of forms which may be used in reply to them. For example, Yes I saw the insurance company, is just one of a great variety of sentences which can occur in reply to Did you go to town yesterday?

It is primarily the variety of lexical items permitted in responses (and utterances) which enables language to function as a means of giving expression to the enormous range of stimulation which a human being encounters. However, on the syntactic side, it may be eventually found that some forms such as questions, when compared with others such as statements, show a greater tendency to eliminate verbal response to stimuli outside those of language, ~~in the~~ the semantic items they call forth. For instance, Fries has remarked on the frequent use of yes and no in replies to questions. (S.E. p.165).

In dealing with the formal nature of responses,

(which attracts most of Fries' attention) we recognize that given syntactic patterns allow for only limited numbers of forms to occur in reply. The types which occur most frequently can be listed. But we do not add that these express the syntactic or structural meanings of the original. The structural meaning of a sentence has been understood in this paper to be defined by those forms which will carry exactly the same referential information as the given sentence, by using the same values of the same classes in a different arrangement. Thus we could define the structural meaning of an active form in terms of a passive. I C units could be similarly treated for meaning value and a given sequence defined by its equivalent form in another construction. For example The big boy / likes / the little kittens

= The little kittens / are liked by / the big boy.

(See 2.2.2).

2.32 While it is true that limits are placed upon what forms people may use in any language, the response patterns may not be quite so predictable and regular as there is sometimes the tendency to maintain. It is a valuable observation that a language may be defined as certain sounds which "elicit regular, predictable responses" (S.E. p.35). But some qualification may be needed to the following remark:

"...if language is to fulfil its function of providing

the means of social co-operation, then individual A must be able to predict with considerable accuracy the practical response which particular sounds will elicit in individual B." (S.E. p.35).

It is claimed later in the book, that the response units in English showed great diversity of pattern (S.E. p.53) and answers to questions could illustrate almost any acceptable linguistic form (S.E. p.165). There must also be a great variety of forms permitted in the answers to 'requests' (not discussed in S.E. Chapter VIII) such as Get me an apple. Further, the variety of lexical material used in responses does not suggest that an individual A need always be able to predict the response of individual B with considerable accuracy for language to fulfil its social task. On the other hand, in syntactic matters, if there is complete freedom of choice in form, then intelligibility between speakers is greatly lowered, since meaning reduces to single vocabulary items with relations between them obscure. No language works in this way.

2.4 Classification of Sentences.

The classification which is developed from the general distinction of the two kinds of sentences may also offer a few points for discussion. The basic practice of separating sentences according to their most frequent types

of response can be firmly supported, and indeed some of the most valuable sections of the book occur in Chapters III and VIII. We are provided with three major kinds in the situation group, various types in the response group, and the knowledge that situation sentences may also occur in response utterances. (Chapter XI provides some fresh information on the differences between sentences occurring initially and those which follow. But internal structure is studied there, and so it does not rightfully enter into this section.) Nevertheless, we may meet with some difficulties in attempting to apply the method to a sample which includes more than telephone conversations. The following notes could perhaps increase in importance.

- (1) The class of sentences called 'statements' which elicit signs of attention may also elicit continuous discourse. Consequently, when the frequency of discourse/^{responses} becomes high, it may be confused with the class of 'questions' which arouse oral responses. Study of the internal construction of sentences as well, could then become important, although 'questions' would rarely arouse signs of attention, and the difficulty might be overcome without it.

- (2) It is also not always certain that 'statements' are separated from 'requests' merely by a consideration of response. Away from the phone they could arouse a good deal of action.
- (3) Some structures of the 'question' form can signal 'requests', or, in other words, elicit action responses instead of oral ones, or indeed, give rise to both types of response at the same time. The following examples (taken from S.E. p.150) are capable of arousing both types.

May I speak with -- please?

Can you come over soon?

Will you talk to Miss M -- about it and let me know?

Fries observes ambiguity of response in the last 'polite' example, but not in the previous two (S.E. p.164).

Again, we may compare:

Go to town tomorrow. (request)

Will you go to town tomorrow? (request or question)

As with Get me an apple a wide range of oral as well as action responses can be imagined, despite the note that "one of a narrow range of oral responses may accompany the 'action' response. It is however the regularity of the 'action' response that constitutes the pattern here." (S.E. p.48).

Though the sample of telephone conversations did not show the features described, it may be that other samples will do so.

Finally, as Fries states (S.E. p.40, pp.164-5), a study of responses shows a class of sentences which have the same form in both situation and response situations. These may become so frequent in some samples that the method of classification is of little value. This by no means makes the type of approach invalid, as clear differences between major types of sentences have been established in the chapters mentioned. (Although the Class 2 tied by concord to Class 1 formula should be dismissed in favour of the more common 'question' forms noted by Fries.)

But even in the material which was examined, 'statements' formed the greater part (S.E. p.51), and we expect to find these both as response and situation units. The method would be more valuable for spoken language, than for that kind of written informative literature where the flow of material does not depend on question and response. Internal analysis of 'statement' type sentences would then provide the basic means of classification.

- ¹ Bloomfield, Leonard, Language, (New York, Henry Holt and Co., 1933), p.170.
- ² Sledd, James, in a review of S.E., Language, 31 (1955), p.341.
- ³ F.W. Harwood has pointed out in discussion the English feature of choice in use of comma, semi-colon, colon, full stop and etc., which has been developed here.
- ⁴ Harwood, F.W., "Axiomatic Syntax", Language, 31 (1955), pages 409 - 413.

CHAPTER 3.

WORD CLASSES.

3.0 Introduction.

The attempt by Fries to handle parts of speech as structural meaning units into which word classes enter, shows an attempt to deal with too many features of English at the one time. Although it may be seen that he was aiming to present the diversity of free form patternings in which words with certain bound form ranges can occur, the result has provided suggestions for future research, rather than a clear statement of the formal characteristics of English words. The definitive criteria for the parts of speech are not precise, and there is also a tendency to proceed from meaning assumptions to form, instead of from form to meaning by way of strict descriptive analysis.

Without firmly established word classes, any statement of the rules for creating sentences, or any analysis of sentence structure, will be incomplete. Consequently the parts of speech have here been treated at greater length than some other aspects of Fries' work.

3.1 Fundamental Claims.

3-11 In preparation for discussion which will amplify and support the criticism just made, some basic ideas for the analysis and presentation of English word classes may be stated.

Distributional studies will show that it is often valuable to keep the study of the classification of words according to the bound forms they may take, separate from one which describes the words as free forms in positional arrangements with each other. When the two activities are confused it can be easy to create classes that do not have consistent and clear cut characteristics. (See 7.3 and 7.4). Here we use 'word' as a term for a free form which may contain inflection or word formation¹, as well as for one which contains no bound forms at all.

It is a feature of English that a class of words capable of using a specific range of inflectional endings, may enter a free form structural sequence in the same position as one or more classes capable of being characterized by different inflectional endings. Thus the position need not be a unique marker of one class and can not be used to describe it in this way.

On the one hand the inflections of words may be grouped to define and characterize parts of speech, and on the other, the positions which one or more of these parts

of speech can enter, may be stated separately in order to describe their behaviour. Perhaps a re-definition of the constructed classes may follow for various purposes.

There would be subdivisions, for example, within an inflectional group because boy+s but not boy+'s, will appear in The - walked over the bridge. There would also be new groupings because a variety of inflection classes will fit such frames as the -, or the n+o v+s-.

It has happened more than once in descriptive studies of English, that ~~some~~ words with the same free form positions have been held to be the ~~ones~~ *having* the same inflectional endings. But it is not possible to say that both types of frames consistently provide the same types of classes. They do not. The tendency to place the free form positional frames in which word classes with certain inflections may occur, as characteristics of these same classes, has not always been discriminate.

3.12 A method of analysing a text recommended in this paper, is to set up classes of words which all take the same set of inflections, and then to examine where these inflections occur in positional sequence. Thus +'s occurs on a single morpheme word of the noun inflection class in The boy's coat is on the hook, while the other inflections are excluded. A formation rule can be introduced to this effect.

such as n/v or n/a,

Where we find a member of a class[^] which takes more than one set of the inflections which mark out an already defined class, such as n/v or n/a, the following procedure can be adopted. We state, for example, that the members are to be noted as either nouns or verbs, but not both, according to the particular inflection (not to) used in the given frame, and according to whether a member of the exclusive noun or verb class will occur in the same position. Thus in The boy hits the ball hits can not be treated as n+s because no member of the exclusive n class ever appears in such a frame. Again, in The men worked hard +ed and the position of work in relation to the rest of the sentence makes work a verb and never a noun.

In other cases we may find words which take more than one set of inflections (with each set capable of characterizing a separate class) occurring with a zero bound form. In these circumstances the test of whether a member of one of the unique classes can appear, will again determine the symbol which is to be used to denote the form of the word in question. Thus in He likes the amenities and the work, and The aim of sport is to improve the body, but that of study is to improve the mind, work, aim, sport, study and mind must all be marked as n because only members of the exclusive n class will appear in these positions. In a similar way verb and adjective overlap can be treated: the

mature philosophy. Again, v+n and v+d can be used to denote the function of v+o in The children hit by the ball and The children hit the ball and etc.

A preliminary analysis of the frames which distinguish one class of words with a particular set of inflections and not another, or which distinguish a class with one particular inflection and not another, has shown that in some cases the overlap can not be eliminated. For example, take We discussed the problems as products of the atoms grouped in different ways. Here grouped is either v+n or v+d, and the sentence has an ambiguous meaning. But such cases were quite infrequent. They require further research, especially in view of recent suggestion that ambiguities of structure are common,² and again in view of recent stress laid upon the need to analyse sound features of spoken language³. These last may eliminate ambiguities.

One point, however, is clear: n/a overlap remains in left expansions of nouns. In the vigorous intellectual effort, and the material world, intellectual and material can be treated as either nouns or adjectives, because they take the +s plural, and the +ly inflections, and because the +o forms of both classes occur as here in these positions. But this overlap is not so important in questions of ambiguity. It could be treated as a feature of English which enables us to set up a separate class

with certain positional characteristics.

We thus see how positional characteristics can be combined with inflectional ones, either to define word classes, or else to provide formation rules for classes defined already by the inflections and other bound forms.

In either case, we may conveniently choose to hold a positional sequence as a feature of one or more classes, each class having a unique inflectional range. There is no need in these circumstances to re-arrange the separate classes already set up, and to create n/v groupings etc. The special position can be treated as selective of a class with a unique inflectional range, which therefore makes the members of overlap classes in this position members of a unique class. (Subdivisions of the classes according to the occurrence of each of the inflections belonging to the unique range - eg. ts opposed to t's - would, however, remain). But there will be other cases where a position is not selective of one unique set, as we have seen.

3.13 As a result of these considerations, and because of the variation in syntactic content and length of the position sequences which are capable of determining that one and only one class will occur in instances of formal ambiguity, the following is maintained. It is necessary to examine in turn sequences which may be sentence

long, in order to find out what exactly can occur before and after what class symbols. For example, only one class will occur in The n + o v + s to - him, but more than one will occur in He went to -. It may be that a large number of morpheme positions needs to be examined in some cases before the - can be found to be determined for one and only one class.

If it is wished to make positions diagnostic of a class in a fixed fashion, then formation rules must show the sentence patterns under which the defining features do or do not hold. (See 7.42).

In other words, it is useful in English to examine any individual word class or word constant position in relation to each of the possible combinations of the classes and constants in each of the sentence types with free and bound form positions marked 1 n. Thus, for example, in The - are a+o we can learn that n+s, a+o and v+n will occur, but in - v+s a+o, we can learn that v+n will not occur, and that a+o will do so only in some idiomatic phrases (eg. Good makes good).

The need for such exact positional studies has not been adequately realized by Fries nor by Harris, whose works have been so important in leading us to distributional studies in the first place. However, it can be seen that Fries edged towards a recognition of the problem in his theory of diversity of strike. Harris also approached it

from the side in his difficulties over approximation techniques, and in his discussion whether long or short selected environments should be made diagnostic of the same class. (See 7.12, 7.13, 7.31, 7.32).

3.14 It should be clear by now that it is not suggested that bound form characteristics provide the only means of class definition, although they may be the most convenient. We could distinguish classes by using a set of free constants, or position after another large class, or concord, (in this case we would use a bound form belonging to a word which is not a value of the defined class), or etc. Other features could then become parts of the formation rules. But the system outlined is probably the simplest to manipulate. (See 7.4 for further discussion about the nature of word classes. The analysis of a text could proceed on slightly different lines which are indicated there.)

It is evident that when we are setting up classes of single morphemes in a more precise analysis of a text, that is, when we are finding the exact minimal syntactic units of it according to 7.4, the same procedure of taking sentences in turn is to be adopted. Once we have developed word classes, we can treat sequences of their positional combinations, and if we like, consider their structural meanings. Such combinations would be characterized by

(1) the word classes and constants which may enter them, and (2) the positional arrangements of these word classes^{and constants}, with each bound and free form position numbered serially. They would correspond to the 'structural patterns' defined by Fries (S.E. p.257), and clarify the limits of the structures 'modification', 'subjects' and 'objects' etc. which he treats..

3.2 The Methods of Analysis which Fries claims to use.

3.2' The initial methods by which Fries claims to have established the parts of speech or word classes are given as follows:

"We have assumed here that all words that could occupy the same 'set of positions' in the patterns of English single free utterances must belong to the same part of speech. We assumed then that if we took first our minimum free utterances as test frames we could find all the words from our materials that would fit into each significant position without a change of the structural meaning." (S.E. p.74).

"After using the minimum free utterances we tested the resulting lists [of words] in the 'positions' that appeared in the single free utterances that were not minimum but expanded in various ways." (S.E. pp. 74-5).

It is important to realize that except in one instance (S.E. p.78) the 'positions' referred to by Fries in the test frames consist only of the positions of words as free forms in relation to one another. (See also S.E. p.141). (This contrasts with work done by Harris where the relationships of bound forms to free forms are also initially considered). The term 'positions' will consequently always be used in the section on Fries to refer to free form occurrences.

The basic features of the procedure then, may be pointed out in this way: (1) all words which occupy the same set of positions in diagnostic frames will belong to the same part of speech; (2) all members of a part of speech will have the same structural meaning; (3) tests for both characteristics are to be carried out on minimum free utterances; (4) resulting lists of words are to be tested in positions in expanded utterances.

3.22 However, there is a fundamental modification due to the theory of 'diversity of strike' presented earlier and later in the book:

"There is no single characteristic that all the examples of one part of speech must have in the utterances of English. All the instances of one part of speech are the 'same' only in the sense that in the structural patterns of English each has the

same functional significance." (S.E. p.73).

We understand that this means that a part of speech varies in its use of a limited range of formal devices, according to the structural pattern in which it occurs. These varied patterns are united however, in exhibiting a unit of structural meaning which correlates with the one part of speech. (See S.E. pp.69-70).

Consequently basic qualifications are introduced to the method of discovery described. The remarks indicate for one thing, that words with the same set of positions, that is those words all having a characteristic in common, need not belong to the same part of speech. Yet Fries is not clear that a contradiction in procedure has been made, for he later claims to have used the assumption that words found in the same set of positions will belong to the same part of speech. (S.E. p.110).

3.23 We are really left with a feature of procedure which will be discussed again. A habit of choosing one or more positions as diagnostic of a particular structural meaning appears to have developed at least partly because of the theory of meaning just described, and it conflicts with attempting to find words with all the same sets of positions. It has been hard to decide whether (1) is to be followed exclusively or whether other characteristics are to be used.

In any case 'diversity of strike' makes it essential for us to rely on feature (2) as the means of defining the classes. It will be seen, however, that even this means is not consistently used, and that the whole method of classification becomes quite confused. As Fries himself holds, a control of meaning to the extent of discovering either through responses or an informer, what forms have the same structural meaning, is essential to his work. (S.E. p.8, p.74-5, p.79 footnote 13). But he does not realize that in theory at least, 'diversity of strike' makes 'meaning' the only real defining characteristic for a part of speech; that it is only through structural meaning that we can bring the different formal features together as characteristics of a single class. For example,

"our analysis starts from a description of the formal devices that are present and the patterns that make them significant and arrives at the structural meanings as a result of the analysis."

(S.E. p.57).

This appears to be incorrect. (See also S.E. p.203). Meaning decisions must be made initially.

3.24 The method of discovery first described is also qualified by remarks in various places concerning the value of bound forms in defining classes, and by the lists of these forms given in Chapter VII. They are said to be

discovered through the positional tests in diagnostic frames (S.E. p.79), and are to be separated as markers from the positions themselves (S.E. p.141). (Although diagnostic frames for Class 1 include -s). Both are consistently held to mark out the same classes (S.E. p.74, p.110-1, p.112), and we may see that Fries can attempt to establish this claim through the theory of 'diversity of strike'. For he recognizes that inflections, as characteristics in isolation, can provide word classes which conflict in membership with the classes of words marked constantly by positions.

".... certain formal matters outrank others in determining the class of a function unit in any particular utterance. In general 'position' markers in any particular sentence supercede morphological or form markers." (S.E. p.141).

But we will see that in practice inflectional ending frequently takes precedence, and that there is indeed a firm dependence on inflection not only for the description of classes, but also as a means for their discovery. It is greater than Fries is aware, and probably due to the fact that there are bound forms which may be made absolutely diagnostic of word classes.

3.25 In summary then of discussion so far, we tend to find that Fries has actually discovered his parts of

speech by selecting meanings which seem to have a traditional basis, and by classifying words according to inflections and word formatives (with which the meanings have been associated). Both features may account for the choice of certain of the positions as diagnostic, because a frequency count may show that the word classes thus established occur very commonly or else exclusively in some of the frames.

We may now see from the previous paragraphs that the theory of 'diversity of strike' has been an attempt to overcome the opposition between positions and bound forms described in 3.1. But we can hope for its success only if a clear knowledge of the structural meaning for each part of speech is known in order to keep it distinct from others, and, it is highly probable, only if one structural meaning is permitted to define it. The theory presents us with a number of problems. We shall see that in practice Fries satisfies neither criterion.

An attempt to follow out his method of discovery is further confused by the fact that we can not be clear as to what "a part of speech" means. The reader may have already noticed that 3.2 began by using the expression "parts of speech or word classes". It has also been convenient to describe a part of speech as a "unit of function", or "a class of words with the same structural meaning", without

any attention to looseness of definition. This is because Fries himself at times describes a part of speech as a functional meaning unit, while at other times he accepts it as a class of words. As a unit of function it permits words to enter more than one part of speech, and satisfies the claim that we are not to list words in classes with constant features, because of 'diversity of strike'. In this case, as we have seen, both positional and bound form frames may be able to define the one part of speech. But as a unit which lists words with characteristics in isolation from their occurrences, the part of speech exhibits the opposition to which we have referred.

With all these remarks now in mind we may proceed to a more detailed study of the confusions in the establishment and description of the classes presented in the work.

3.3 Meaning Problems.

3.31 One of the first which comes to mind is the fact that the dependence on structural meaning which Fries accepts (S.E. footnotes p.8, p.74-5), has permitted the introduction of dubious uses of 'meaning'. For example, it is frequently assumed that some unstated structural meaning belongs to a particular part of speech, though whether it exists or not is never really shown. It may be possible to set up somewhat different structural meaning units from

those usually accepted, with consequent slight change at least in the parts of speech established.

In any case, a concept of structural meaning is never defined in relation to any particular class, and always remains an obscure notion behind each one. For example, when the class I words are divided into three sub-groups by the test of which one of the substitutes he, she, or it may be used in their place (S.E. p.121), we are told that this activity provides identifying characteristics for important structural meanings discussed in Chapter IX. But the way in which the different meanings are linked into a group to satisfy class 1 is not explained. Again, we are provided with the old subject and object positions for class 1, as well as the frames the -, and -s in frame A. In what way are their structural meanings the same or different, and how do they link up others, and so on?

In some cases we may even find a primary dependence on meaning in order to pick out a position as diagnostic. A list of class 4 words will illustrate this point. (S.E. p.139 (d)). It covers a wide variety of words, and in fact, footnotes 16 and 17 on the same page make it clear that a meaning assumption, and not positional analysis of the occurrences of the words, is the means by which they are grouped together.

Consider We went down

The chair is down the garden

The man down the street

What is it that picks out one of these positions as diagnostic for class 4? What is it that picks out one of the meanings as important for class 4? Perhaps a statistical study could supply some answer. But it does seem that a structural meaning is here first assumed for a position, and that it is set apart. It need not necessarily apply to other uses of the same words.

While a study of structural meanings is quite legitimate, it can not be arbitrary, and precise methods for their discovery need to be used.

3.32 A second major problem, and one which is recognized by Fries (S.E. footnote p.56), is the difficulty of separating lexical from structural meaning. Just how are we to determine through 'responses' and our knowledge of a language, a control of structural meaning as opposed to lexical? Later sections of this research may provide some answer, and show that a decision on the question is fundamental in any study of syntax.

The question of how we may overcome semantic combinations of words in distributional studies in order to establish a syntactic analysis is very important, if we base our classification system on the view that all words

which occupy the same set of positions belong to the same part of speech. This is a problem which relates not only to Fries' work but also to that of Harris.

A study of individual words in distributional relation to one another will not necessarily show that they belong to one form class. The point is that semantic differences may exclude many words from fitting positions in sequences taken as frames for the descriptive study of word occurrences. In the frames

The cars -- smoothly

The fires -- brightly

how are we to know that a collection of words which fills the blank in the first is the same formally as that which fills the second? What is to unite the two different semantic groups into one form class?

What is required is a procedure which is proofed against generating semantic combinations in mistake for syntactic ones. The stress by Fries on free form positional and meaning analysis does not give one, and the work by Harris on pure distributional analysis is not complete.

It is not meant here that large numbers of semantic groupings would not be valid as descriptive analyses if they could be brought under control. They could be useful if formation rules could be given which would develop them

into valid sentences of English. But we must be able to recognize that they do not supply the syntactic nature of the language. Some means is required of showing that words which do not occur in the same sentences are yet formally the same.

3.33 In 7.4 a method is presented which it is hoped refines both Fries and Harris in their theories of how to discover syntactic features. It is linked with the definitions of syntactic classes and constants in 4.3 of the next chapter.

Here, for example, a syntactic constant is a single morpheme which must be used in a particular position in any one of the varied sentences with morpheme positions 1 n, in order to make the sequence a sentence. That is, no other morpheme at all will substitute for it in this particular sequence in order to create the sentence.

Thus in The children -- the--s run quick--., fly is the only form which can fill the last blank, while a very large class can fill the second, and a small class called p (or similar) can fill the first. We may consequently call fly a syntactic constant, while the free forms are called object language or semantic members of two very different syntactic variables. By this theory syntactic elements can be separated from semantic ones.

It will be seen also that it allows morphemes which

can be treated as members of one class in some sentences, to be subdivided into different classes in others. For example some of the members of the class p just referred to will have different occurrences to others. Thus by and with will occur in passive constructions, but other values will not. Again, those words which appear without any inflectional ending in constructions like the -, can be subdivided into verbs and nouns in cases where they take one of these inflectional forms. And again, +s and +ed can be considered members of one class in such sentences as The wound-- are here, whereas they can not be treated in this way in other sentences. How to differentiate the nature of such classes will be described more fully in 7.4 to follow.

When we come to setting up word classes in Fries' manner, instead of morpheme classes in the manner above, we can treat the analysis of the substitutions of more than one morpheme at a time, as a special case of study of sequence substitution.

For example, combinations of morphemes like v + n and n + s can be treated as members of one class because they can be found in frames like the -, but in others they will not substitute for one another in order to create any kind of sentence. That is, they will occur in exclusive positions. It is possible to define words as a class in

relation to free forms for one particular kind of sentence, and then re-define them in relation to bound forms for other kinds of sentences.

It is interesting to observe that when small classes such as t define a class, we may be able to set up structural meaning units which differ from those Fries would possibly provide.

This brings us to the final point of discussion about meaning. Because of the previous theories it is held that the two useful meaning conceptions are "lexical" and "structural", and that the introduction of "social" meaning by Fries is invalid (S.E. pp.294-5).

It is really a part of lexical meaning or semantics. Rip's sentence in the first case given by Fries, would convey the social meanings of his time through the emotive or referential values of the words, that is, through their lexicon. Communication breaks down in the second case because while Rip uses one lexicon, his audience of another period uses another. There is no need to set up a basic idea of 'social meaning'; instead, we may state the lexicon for any given time or place.

3.4 Significant Positions.

3.41 Reference has already been made to the question of whether Fries desires to classify words according to selected diagnostic positions in which they occur, or whether he desires to put them in one class if they all occupy the same positions in both minimum and expanded sentences. In either case, question may also be raised concerning the claim that all members of a part of speech will display the same structural meaning. It will be found that in treating the three different points Fries has created some confusion.

3.42 Classificatory theory (S.E.pp.74-80, particularly pages 75 and 78), leads to the belief that certain positions are to be held diagnostic for a class, while others are to be considered less important. Thus for class 1, test frame A seems to be diagnostic, while for class 2 three test frames are diagnostic (S.E.pp.80-1).

It may immediately be asked why the minimum free utterances (in sentences) chosen as frames, hold significant structural positions and meanings for words over and above their other uses. It may be that firstly the sentences themselves are of high frequency, and can be selected to establish parts of speech on this basis alone. But a precise statistical study might make us enquire why other commonly found sentences such as The boy is in the

garden, of the type t n + o is p t n + o, are not also selected.

Secondly it may have been realized that there are certain common sentence frames in English which are diagnostic of a particular range of inflections. As Fries uses inflections to describe the parts of speech in Chapter VII, we may suggest that a link between the positional use of a word and its inflectional range was attempted. Thus in the frame The concert -- good, only the range of class 2 inflections can appear. But in other frames, The -- was good and The clerk remembered --, words of the form v + n, a + o or a + ly, and n + s will occur. These are never grouped together in one class. (Though a + o, and n + o are recognized as able to occur in the one structural unit (S.E. p.118)). The frames for Fries remain diagnostic of certain ranges of inflections only and the others are ignored. It is a pity that he failed to pick out frames which were always diagnostic of the inflectional classes he uses in Chapter VII. As it has been pointed out, a full study of the arrangements of classes and constants in sentences of varying lengths will probably show that there are a large number of long sequences capable of determining the occurrence of one and only one class symbol in a given sentence pattern.

3.43 However, as the work of Fries now stands, we must immediately recognize that the selection of diagnostic positions is rather arbitrary, and cuts right across the classification of words according to the characteristic that they all occupy the same set of positions. This may also be seen in the fact that no class of words similar to n/v or n/a is ever established, (although it is true that 'diversity of strike' enables a slightly different recognition of such features at times.) (See S.E. p.118). Again, note that the diversity of positions a class 4 word may occupy are not made clear. For instance, often will appear before went in frame C. (S.E.pp.83-5). (There may be some general realization of its patternings in Chapter X, although it is difficult to assess Fries' mind here).

In short, classification of words according to their same set of positions can not be reconciled either with the use of selected diagnostic frames, or with classification according to their same sets of inflections.

Nevertheless, it must be pointed out that Fries does consider that the variety of positions a word may occupy are not to be disregarded.

In an attempt to discover what importance the other positions have in relation to the diagnostic positions we may suggest the following. If a word which appears in the

diagnostic position or positions of a class, appears in other positions also, then it will still belong to its diagnostic class no matter what structural meanings belong to those other positions, so long as none of them is one of the diagnostic positions of another class. For example, Fries himself superficially establishes class 1 as a set whose members all appear in frame A, and which may appear in other frames as sub-groups as well. (S.E. p.78).

Although such a practice does give us some explanation of how Fries treats the variety of positions in which words may occur, it certainly shows that he does not satisfy the claim that words which occupy the same positions will be classed together.

The procedure might work if the original selected diagnostic positions for a class always exhibited the occurrence of a range of inflections which corresponds with the range of inflections which are later used to define the same class. We have seen that this is not the case. So although it seems to approach Fries' habits, confusion still remains. It becomes apparent at this stage that there is really no consistent method used at all.

3.44 The procedure that has just been described also cuts across the characteristic of sameness of structural meaning, as previously observed.

In order to make the use of diagnostic positions reconcile with the test of same structural meaning, we can ask whether the 'significant' position can be said to carry a structural meaning which is more important than others, or which words in other positions exhibit. If so, then we must hold erroneously that different positions do not carry different structural meanings. A class 1 word, for example, in modifier position, will surely not have the same structural meaning as one in head position. But it is still found as class 1. (S.E. Chapter X). (Possibly this is because it will not fit both diagnostic positions for class 3, although a v+n form will fit both frames for class 3, and is still treated as a class 2 word in the modifier frame).

It has to be admitted that the use of diagnostic positions confuses quite arbitrarily with the use of other characteristics. It has also to be admitted that in fact no one structural meaning is correlated with a single part of speech. Various examples may be found where this is so. It would be very hard to establish a sameness of structural meaning for all the class 3 words listed (S.E. p.83, footnote 15), and another for all class 4 words in frame C (S.E. p.84) unless they were each of the traditional kind vaguely called modifier of a noun and modifier of a verb. It is to be noted that Fries himself describes variations

of meaning for words in modifier and other positions.
(S.E. p.203).

Even if the view is taken that the structural meanings in the diagnostic positions alone are important, while the rest are to be considered of minor value, it is clear that varying meanings are permitted in the one class. Test positions in the diagnostic frames provide different structural meanings regardless of what happens in expanded sentence structures. The position of class 1 before a transitive verb, for example, can not be said to have the same meaning as the position after.

Fries is well aware that a position will vary as to structural meaning, for instance in his theory of diversity of strike, and does recognize that different inflectional form classes used in the same positions will provide different structural meanings. But he has failed to make such recognitions in presenting the use of diagnostic positions. Thus the whole method is inconsistent, and fails to satisfy his requirements. (S.E. p.8, footnote 6, p.79, footnote 13).

3.45 In summary then, we have not been able to find that a formal and not an arbitrary procedure has been followed. Certain positions, along with their structural meanings have been picked out in preference to others for an unstated reason. Same sets of positions and same

structural meaning in all positions have both been discarded. This could be due to traditional meaning assumptions, or it could be based upon statistical studies of occurrence, or could be allied with the occurrence of certain ranges of inflections.

We shall see later that the given positional analysis is in fact made subsidiary to a primary inflectional classification.

3.5 The Opposition of Inflectional and Positional Characteristics.

3.51 It will be convenient now to amplify previous remarks concerning this heading, and to enquire how much Fries holds the study of bound form inflectional occurrence to be important in the initial establishment of the parts of speech.

We may begin by taking some quotations from Chapter V. We may then proceed to deal with other groups of remarks.

A. "It is not enough for our purpose to say that a Class 1 word is any word that can fill certain positions in the structure of our sentences, even if we enumerate all these positions. We want to know what the special characteristics of these words are that make them recognizably different from the words used in other positions." (S.E. p.79).

Again: "In Chapter VII we shall enumerate and describe the various contrasts which we have found to mark the parts of speech in English. In the rest of this chapter we shall sketch the procedure used here in the attempt to discover inductively from the recorded materials what these various contrasts were." (S.E. p.74).

Apparently then, the main use of inflectional studies is in description of classes already established by positional means.

B. However, remarks made later in the book tend to modify this point of view.

The first occurs in a summary remark upon the identification of function words:

"The procedure here employed was the same as in the chapter for the setting up of parts of speech. In both we took from our materials single free utterances as test frames and, by the process of substitution, tried to find the words which, with the marks they had in their original utterances, could be used in the test frames without a change in the structural meaning." (S.E. p.104).

It is a little disturbing to find this statement some time after the method of analysis by positions has been presented. It may be seen that an attempt is made here to

show that both bound forms and free forms mark out the same classes. We assume that "the marks" include inflections, and find that the claim will unite into one class some words which Fries treats in separate classes. For example v+n, a+o, n+o may be taken from their original occurrences and found to fit the diagnostic frame The - n+o. We may also find that at least one class which Fries recognizes, has members which do not satisfy the claim. For example, if boy's, which occurs in The boy's hats is placed in frame B for class 1, it will be found that it can not occur here, although it is a word which belongs to class 1. (S.E. p.118).

The second attempt to show that both inflections and positions have the same diagnostic value is made a little later:

"Our procedure for finding these identifying characteristics was a study of the contrasts between the forms of the items in our lists for each of the four classes in the frames by which they were tested.

This examination gave us not only contrasts in the forms themselves but also contrasts in the formal marks of the various 'positions' in which each of the classes could appear. Our identifying characteristics, therefore, are of both kinds. We are not concerned here with classifying words in isolation but solely

with these items as they occur in live utterances carrying on conversations - with the practical functioning of language." (S.E.pp.111-2).

Now it has already been maintained that such a general practice can only hold if a single structural meaning is established for each part of speech, because inflections and positions may mark out different classes of words. Words capable of using entirely different inflectional sets will appear in the same free form frames. For example The fireman catches ^{up} quickly, shows a set of words which may occupy the same positions but which are not ever capable of all using the same inflections. Failure to recognize this is repeated.

The important feature of the last quotation is the statement that words are not to be classed in isolation from their positional uses, by taking account only of contrasts in the forms of the words themselves. (Compare S.E.pp.139-140).

C. In other places this appears to be modified, if not contradicted, and indeed, it will be found that the following set of references is at odds with the tenor of the previous two quotations. Here we find a major tendency to rely on bound forms alone as the means of distinguishing word classes. The remarks occur in the description of classes already established by positional means, and have

not been used by Fries in presenting methods of analysis, but nevertheless show a recognition of the diagnostic importance of bound forms.

Some comments (S.E. pages 122, 126 and 132) do indeed contrast rather curiously with the repeated claims that parts of speech are to be set up according to the positions that the word members occupy.

"The distinctive positions of class 2 words in recognized structures provide some of the clues by which to identify the units in utterances that belong to this part of speech." (S.E. p.126).

Positions have now become no more important than other features in diagnosis, and elsewhere (S.E. pp. 122 and 132) it is actually said that they are less significant. Again, it is even pointed out that classes 3 and 4 can occupy the same diagnostic frame and be differentiated only by study of the forms of the words themselves (S.E.pp.135-7). Classification by position is set aside.

3.52 If A, B, and C are compared, it is easily seen that the theoretical diagnostic value of inflections and other bound forms is quite obscure. Despite the theory that parts of speech are defined by finding words with the same set of positions and with the same structural meaning, the actual description of the characteristics of the classes continually suggests that it is inadequate.

Fries alternates between the use of position and the use of inflection and this can not be explained by any theory of diversity of strike, that some one structural meaning enables such a fluctuation to happen.

For instance, although he makes the rule that when positions and other markers conflict, the positional markers are in general to take precedence (S.E. pp. 112-3, p. 141), and although he follows this out in some cases (S.E. p. 118, (f)eeetnote, p. 125, (f)eeetnote) there are many in which he does not. It is the aim now to show that in actual practice the method by which the four parts of speech have been set up has been primarily through analysis of inflections. (And it may be remembered, that even in this case, an inflectional range, or any list of bound forms as in S.E. Chapter VII, need not mark out a single structural meaning. Eg. +s and +ism mark out class 1 in Chapter VII.)

3.53 Firstly, even in the diagnostic frames it is evident that some words which are given the same class head, will fit one frame but not another. What is it that enables them to be brought together in such a way? A similar question may be asked concerning 'structures' when we read:

" ... the names 'subject', 'predicative', 'nominative', 'appositive', 'direct object', 'indirect object', 'object

complement', 'adverbial object', 'noun adjunct' are the names of structures in which class 1 words appear." (S.E. p.210)

Again, what is it that puts a limit on the positions a word of a class may occupy, and the meanings it may use?

Fries might agree that the estimates of the positional occurrences of words are only of an introductory kind. But it may be added that the choice of certain positions as diagnostic leads to oversight in recording the diversity of positions in which a word may occur. If we are going to find parts of speech by listing the words which appear in the same set of positions, then it is necessary, for example, to recognize the group of words which appear in both class 1 and class 2 positions. The use of words with the past tense inflection, or of words which in the present can not also be used as class 1, in the test frames for class 2 (S.E.pp.80-1), tends to make us forget this feature of English. For example, a word like "run" may occur not only in frame C for class 2, but in frames A and B for class 1 as well.

It may be held that Fries is not really attempting to set up lists of words, but to establish structural meaning units which may show the use of the same words in different ways. This may be true in some places (e.g. S.E. p. 62, p. 118), but it is not his stated practice

when he discusses the use of test frames.

It must be observed then, that words are not simply listed according to the positions they occupy.

3.54 Some clear examples of the classification of words according to inflection may now be given by discussing features of the four parts of speech themselves. S.E. Chapter X is important here. A reading will show that there is a realization that words with different endings will enter the same positions and that when this occurs inflection becomes the obvious means of class identification. (For example, S.E. p.208, p.218, p.231).

"The 'modification' structures with class 1 words as heads may be formed of any of the four parts of speech or all of them together." (S.E. p.210). Such a statement permits words which enter this and the second diagnostic position for class 3, to retain their class names according to their inflectional characteristics. Position is quite discarded as a marker.

We can find that such words as the following in the diagnostic frame A position for class 3 can frequently occur.

Frame A sequences: hospital gardens
elephant zoo
rich workers
gas lights etc. etc.

There is no marker evident here which enables us to separate elephant and gas from rich, and there is no reason provided in the book why we should. Yet practices in S.E. Chapter X make it evident that we ought to do so. Is 'rich' to be separated because of its use in positions which the other words will not enter? In that case, it would seem that the theory of diversity of strike, with its insistence that units of structural meaning have varying formal patterns, would have to be discarded.

There is neither a positional nor a meaning reason why 'rich' should be called class 3 and the other two words class 1, for these last, like other words, will also appear after the verb in frame B.

He was elephant enough to break it.

It was gas.

Charity is love.

Her name is dirt.

Their bones are dust.

The fair was fun.

He was friend and enemy both.

Language is thought.

His words were law.

One virtue is faith.

The conclusion is that the separation is made because rich is capable of taking a range of inflections

elsewhere, which the other two words are not. The same applies when a word with the inflection + 's appears in the diagnostic frames for class 3 but is still called class 1. (It may be remarked that n + 's is also considered a group A word. (S.E. p.89). Structural meaning must have been totally set aside here).

The conclusion also applies when words such as injured, clean, worn (which occur in class 2 positions) appear in the modifier frame for class 3. Because of their 'modifier' meaning and positional characteristics, words of this kind should no longer be considered class 2 at all. (Yet see S.E. p.208 for contradictory practice). It is of interest, again, that although words of classes 1, 2 and 3 may all appear in the one meaning and positional unit, each is differentiated from the other.

The absence of recognition of positional characteristics can not be explained by any meaning theory; one, for example, which would claim that v + n in class 3 positions has a different structural meaning from other types of words. The variety of words, and of inflectional and word-formative characteristics that are listed (S.E. p. 83, footnote 15) in class 4, does not suggest a meaning problem is posed. It appears that Fries' ideas on when a structural meaning is changed, and when it remains the same are not clear, or not even always studied.

Turning now to class 4, we may note that the naming of its members is said to depend on the ability of words to fill a position before or after the verb in order to modify it, as well as the position before a class 3 word, where they also have some sort of modification meaning. They may also occupy some other positions. Consequently, they appear to have a number of structural meanings.

Now all these features seem to be permitted, because the class 4 words, except for a few, are always characterized by +ly. (See S.E. p.235, p.228). For those which are not, the reason why they are considered class 4 is not at all clear. Again, how class 3 is separated from class 4 is not explained in examples. (S.E. p.135-6).

It is true that Fries is aware that there are unsolved problems concerning class 4 (S.E. p.227, footnote 18), but we may link the tendency to confusion with the following general assessment. Neither position, nor meaning, nor even inflection at times, can consistently tell us what part of speech a word belongs to, even though there is an inclination towards an acceptance of inflection.

For a final example of incoherent practice, it can be seen that not only class 1 words will appear after group F (S.E. p.119), but members of other groups and classes will do so as well. How are we to tell that the words after the Group F value are or are not class 1? For

example, when a word appears after the sequence consisting of a member of class 2 followed by a member of Group F, how are we to tell whether it is class 1, 3 or 4, for all these classes will appear in these circumstances. When there are no inflectional marks existing on such a word, we can not try to find a positional answer, since words of the three classes will also enter more than the picked sets of positions ascribed to each class as defining characteristics.

Again, how do we know that the structural meaning of the position after F is to belong to any particular class, especially if it is one that is different to any previously ascribed to a class. When we come to cases like the men at fault, the men on high, by air, by committee, we do not know whether the last words are class 1 or class 3, unless we consider what ranges of inflections they are capable of taking in any other circumstances.

3.55 In conclusion, it may be seen that a series of contradictions to the claim that words are classified according to the same set of positions has been given. Fries' descriptions of the classes show that there must have been a most frequent, if perhaps intuitive, reliance in the first instance upon knowledge of inflections and other bound forms in order to establish them, with study of positions and meanings, or certain chosen positions and

meanings, in a place of lesser importance.

In fact, the diagnostic positions chosen as a basis for analysis may be linked with traditional meaning assumptions, which are in turn linked with specific ranges of inflections. Words are certainly classified in isolation from their positional patterns of usage.

3.6 Diversity of Strike and Parts of Speech.

3.61. It is difficult to understand what exactly 'a part of speech' means in Fries' system of analysis. On the one hand it is treated as a unit of structural meaning characterized by varied patterns of formal markers satisfying the theory of diversity of strike, and on the other as a class of words all isolated by their regular use of certain formal features. We have just seen instances of the last case.

The confusion created by the attempt to deal with a part of speech in both ways underlies problems we have previously dealt with, and failure in the chapters on the classes to present useful procedures. For example in frame A for class 1, a structural meaning unit is marked out by the appearance of a certain group of inflections in the positional frame before the verb. But at the same time a class of words is created which may not only have this particular positional marker (and range of inflections) but

others as well. Some of the words which can occur here can also occur in the verb position or after the verb. Consequently, finding the devices that signal structural meaning is not kept clear as a single activity.

There is no doubt that a word class can not be correlated with a single structural meaning. For we have seen that Fries shows an aim to classify words according to the positions they occupy. (S.E. p.64, p.74, p.75; footnote 8, and various footnotes giving lists of class words, etc.). This means that because different positions have different structural meanings, various structural meanings will exist within a class.

Yet he insists that there is no characteristic which all members of a part of speech have in common, except the sameness of structural meaning (S.E. p.64, p.73). The parts of speech exhibit a certain range of formal features which are used selectively according to the pattern, i.e. the functional or structural meaning unit in which their members occur. This is the theory of diversity of strike (S.E. pp. 59-61. See also p. 141).

It clearly invalidates any aim to classify words as parts of speech according to the same set of positions in which they occur (since common characteristics have been ruled out), and cuts across the theory described in 3.2 of this paper.

It maintains that parts of speech do not treat words as separate morphological form classes, but that "Our words with particular markings within an utterance become the significant members of structural patterns, each of which signals a structural meaning." (S.E. p.141).

3.62 Such a remark leads into a second type of contradiction. For despite the suggestion that words are not to be classified in isolation from structures, it has been seen in the last section (3.5) that there is a considerable dependence upon inflectional characteristics in order to define them, and that it has been made without a consideration of the positions in which words occur.

It may be held that the use of both free forms and bound forms indicates in actual practice, a habit of listing words regardless of units of meaning, and in isolation from units of function with required patterns of formal features. For example v + d, n + 's and n + o retain their class names in a variety of different meaning structures. Thus boy in the boy's hats is treated by Fries as class 1, even though it is different in meaning from boy as class 1 in The boy hit the ball, and occupies the same position as many other words in the -- room (S.E. p.118). A strict classification of formal features according to a single structural meaning would have to re-classify bound forms under different heads from those given in Chapter VII.

Some practice like the one Fries uses or the one suggested, is absolutely necessary to replace the invalid fabrication of the whole system. If more than one meaning is permitted for a part of speech in Fries' theory, then there is nothing left by which to define a class at all. For a functioning unit is not correlated uniquely with one or certain meanings, nor with certain regular formal features. In order to achieve some clarity we would have to select certain positions and meanings and discard the rest which the part of speech can use. (See 3.4).

3.63 The same practice would also eliminate remarks about words having the same 'shape' in different positions, because the 'shapes' would then just become words with varying formal uses ^{to be classified accordingly - eg. n/a, v/n, etc.}. "These markers ~~to be classified accordingly - eg. n/a, v/n, etc.~~ (i.e. free form function word markers) identify the functioning form-class of those words that have the same shape in two or more parts of speech." (S.E. p.118. See also pp.111-2). A part of speech in this sense is quite different to a part of speech which in Fries' theory, should be established by seeking words which occupy the same set of positions. The positional part of speech would cover more than one meaning part of speech.

However, although Fries may recognize well enough the differences of meaning in different positions, dis-

cussion of contradictions can be concluded with an example of failure to see that positional and meaning analysis can not be combined.

"In the preceding two chapters [we have tried] to classify the words of [our] materials in functioning units - in parts of speech. In that attempt we have assumed that all words that could occupy the same 'set of positions' in our utterances belong to the same part of speech." (S.E. p. 110. See also p.74, pp.110-111, pp.139-141).

3.64 The question may be asked at this point, just what Fries was trying to do with the theory of diversity of strike. One explanation is that he tried to deal with the fact that words with the characteristic inflections of one class may enter the positional frames of another. Slipping between a study of the positional frames and the morphological features of words, he tried to overcome their opposition to one another by establishing functional units, or structural patterns, whose formal markers are diverse.

As a result, the previous sections of this chapter have shown the theory to allow the characteristics of the classes to fluctuate in an arbitrary fashion. For example, how are we to tell the limits of formal variation in a test frame? Practice (S.E. pp.78-9) may show that structural meaning is altered, but theory (S.E. p. 77, p.75

footnote 13) says that it should not be.

The analysis of a single position as a marker of a particular structural meaning is confused with the analysis of classes of words which can occupy a number of positions and have certain ranges of bound forms. The attempt to establish different units of structural meaning as characterized by formal markers of free and bound forms in various patterns, contrasts with the analysis of positional and bound form similarities in order to denote a class of words, not a feature of structure with a single structural meaning at all. The habit of wavering between these different approaches does not make the presentation of syntactic elements in English sentences clear.

3.65 The solution to the series of difficulties which have been examined in this chapter, reduces to separating the use of bound and of free form characteristics as markers of grammatical features. Firstly, the full inflectional range may serve to establish classes of words with constantly definitive characteristics. Then the positions which one or more of these parts of speech can enter may be stated separately. A re-definition of the classes can follow if required, but can not be confused with the first procedure.

What structural meaning or meanings each position has when filled by one of the word classes may then be

studied finally.

A system like this would dispense with the theory of diversity of strike, and re-present the material that Fries handles in a rather different manner. Diversity of strike does have some value in that it recognizes that words with suitable bound forms can enter a variety of positions, or functioning units (S.E. p. 62, pp. 111-2, p. 118). It may be treated as an attempt to describe these features.

3.7 Conclusion.

3.71 A short summary of inconsistencies among the criteria used by Fries for finding and describing the parts of speech may be convenient.

It has been seen that

- (a) The theory of selecting words according to the same set of positions which they occupy contrasts with the selection of a limited number of frames, combined with their meanings, as diagnostic for a class.
- (b) Neither of these features satisfies the insistence on a sameness of structural meaning for a part of speech.
- (c) Nor does the use of inflectional characteristics in conjunction with any positional features, link with a sameness of structural meaning. Consequently the theory of diversity of strike fails, because its primary feature, a single structural meaning unit, is absent.

One unique diagnostic positional meaning (or perhaps more) as the defining feature of a part of speech, becomes overlaid by the acceptance of various meanings.

- (d) The classification of words according to their inflectional ranges contrasts with their grouping according to either selected diagnostic positions, or to the complete range of positions which the words may enter.
- (e) The treatment of a part of speech as a class of words with consistent features but varying meaning values, contrasts with the treatment of it as a single meaning or functional unit which more than one class of words can enter. The term "part of speech" describes the results of two different activities.
- (f) The actual means by which the word classes are established, depends largely upon study of their inflectional ranges. This contrasts with the descriptions of the methods used initially to find the parts of speech. It also enables us to recognize word classes despite the confusing criteria, and the variable uses of meaning, position, or inflection as markers of a class.
- (g) The assumptions about units of structural meaning apparently link with traditional assumptions about the classes of specific inflectional ranges, but show an arbitrariness in their selection. They also seem to have provided a means by which diagnostic frames were

selected, for these are not always definitive of one inflectional class. This contrasts with Fries' view that he proceeds from form to meaning (S.E. p.57, p.203) and not meaning to form.

3.72 Answers to these inconsistencies have been suggested. However, the formal oppositions could be permitted if a part of speech were a single meaning unit, consequently able to link together varied patternings of bound and free forms. Nevertheless, we have seen a number of difficulties in beginning syntactic analysis through meaning and not form. It may also be remembered that the theory of diversity of strike makes an attempt to handle the variety of sequences which bound form classes may enter. The view that word classes defined by inflections may be given their rules as to positional occurrence in any of the patterns of classes and constants in each of the sentences $p_1 \dots p_n$, may be treated as a clarification of it.

It is true that, under certain conditions, both positional and inflectional characteristics may be allied in order to define word classes. The positions in various sentence sequences which permit only one inflectional class to enter, could also be used to define the class, even though its members could appear in other positions which allow the entry of members of other classes. We could apply to their occurrence in these last circumstances, a

test as to whether they will appear also in the uniquely diagnostic test frames. It is unfortunate that Fries' diagnostic positions do not always characterize uniquely the bound form classes he establishes.

The method used in this research however, is to describe word classes only through inflections, and to let their positional arrangements form part of the formation rules.

- ¹ For explanation of what is meant by "Word Formation" see Harwood, F.W. and Wright, Alison M., "Statistical Study of English Word Formation", Language, 32 (1956), p.260 foll.
- ² (a) Joos, Martin in a review of "Machine Translation of Languages: Fourteen Essays" by Locke, William N., and Booth, A. Donald, (Cambridge, Mass., The Technology Press of the Massachusetts Institute of Technology; New York: John Wiley and Sons, 1955), Language, 32 (1956), p. 293 foll.
 (b) Sledd, James, in his review of S.E., Language, 31 (1955).
- ³ See Joos, Martin in a review of "Machine Translation of Languages: Fourteen Essays" ed. by Locke, W.N., and Booth, A.D., (New York, Technology Press of M.I.T.: John Wiley and Sons), Language, 32 (1956). See especially p. 298.

CHAPTER 4.

FUNCTION WORDS

4.0 Introduction.

Much of the general criticism which has been made concerning the establishment of the classes, also applies to the methods of setting up the groups of function words. There can be no doubt that procedure is again hampered by inconsistencies. The reliance upon meaning is too great, while the analysis of distribution too limited, and both provide somewhat uneasy criteria.

However, the attempt to treat the non-inflectional words of English has aptly stressed their syntactic importance. It would be preferable to replace the concept of function words by that of logical constants and that of small logical classes with limited membership.

4.1 Analytic Procedure.

4.11 Two major views provide Fries with a basis for treatment and grouping, and may be aptly presented through quotation.

Firstly, ".... there are no formal contrasts by which we can identify the words of these lists. They must

be remembered as items." (S.E. p. 109). It must be assumed that formal contrasts do not include positional contrasts, for secondly, it is claimed that the placing of the function words in groups depends upon studies of occurrence and meaning.

Thus words which substitute for one another in test frames without a change in structural meaning (S.E. p.104) and words which occupy the same set of positions (S.E. p.110), belong to the same group. In order to find the sets a particular procedure is adopted.

"We shall proceed simply to gather examples of the various kinds of words that operate in 'positions' other than those explored in the preceding chapter, giving identifying letters to each of the different groups as we go;" (S.E. p.88).

"We begin with the test frames used above and explore positions that the expanded free utterances show are possible in these test frames." (S.E. p.88).

It may immediately be seen that it is consequently not quite true to say that for each word "the structural signal comes only through the word itself as a special item." (S.E. p.111). It is a fundamental feature of the groupings that their members should show a sameness of structural meaning. If function words may be put into small classes because they can be substituted for one

another in a particular position without a change in structural meaning, it is difficult to know what makes them items to be treated individually. It can also be pointed out that it is the positional arrangements of various classes and groups which permit or exclude other classes and groups. ThusA 1 - A 1 permits F but not 1, and2 - A 1 permits F but not 2.

Another modification of the procedure is made when it is said:

"That words of the same shape have other uses is not significant in the discussion of this chapter.

Here we are concerned solely with those words in the

function-word 'positions'." (S.E. p.109, footnote .3).

This now means that the groupings depend upon a selection of positions (along with their meanings), while others are ignored, as in the establishment of the parts of speech. For example in the discussion of group A we may read:

"The fact that some of these words (.....) may also appear in the positions of class 1 words does not concern us here; nor does the fact that all and both [members of group A] may occur before the." (S.E. p.89).

4.12 As on previous occasions, we may find in this collection of quotations a confusion of two different activities: the attempt to classify words in lists as members of a part of speech according to the positions they occupy, and in contrast, the attempt to group words according to the meaning units they enter, so that their varied positional uses become diagnostic of not one, but various parts of speech.

We may also find that in any case, there is further evidence that the notion that the structural meaning of function words resides only in the words themselves, is not true. If the function words in themselves carry structural meaning, then no matter what positions they occur in, they will still have that meaning and be treated as function words.

Fries' own obscure outlook is evident when we extract two remarks from the one page.

"The expression who came signals a question not because of a difference of arrangement, but solely because the signal of question is in the word who as a word." (S.E. p.107).

This may be contrasted with

".... in the sentence who came one must be able to recognize this special word who and he must know that this word in itself in that position signals a question" (S.E. p.107).

The phrase in that position makes it clear that for who, structural meaning is not carried wholly within itself.

It may now be remarked that the function words will occur in positions which are not those of the selected diagnostic test frames in expanded sentences. The class 1 to 4 words will also occur in positions other than their diagnostic frames. Since the occurrences of both in other expanded sentences are not clearly analysed, what other positions are and are not function word positions can only be assumed, though probably not entirely, by a study of the inflectional differences of the class words. Inflectional studies again must become a basic feature in procedure.

Finally, even the selection of certain positions as diagnostic for a group, no matter what the other positions may be in which its members occur, does not give us clearly defined classes. We will see that it is unfortunate that the positions chosen by Fries as diagnostic for particular groups may allow members of other groups or classes to enter them. They cease then to be definitive for any one of the given selections of words.

4.2 Examples of Arbitrary Non-Descriptive Grouping. Some Comment.

4.21 In the course of investigation many examples of confusion in method were gathered. Those below provide a selection, and firstly emphasise the major use of primary meaning assumptions instead of the results of distributional studies. The extent of arbitrary decision may be seen by discussing each group in turn.

Group A. "Group A consists of all the words that can occupy the position of the in this particular test frame." (S.E. p.89). Thus the one position is selected as diagnostic from among all the positions which the listed members may occupy. For example, though it is claimed that group A words appear only with class 1 words (S.E. p.89), we know that some can appear in the class 1 position. But the assumption of a sameness of structural meaning for all members which justifies the selection is exceedingly difficult to accept. Words like John's and the cardinals are united with words like the and an. It becomes even more difficult to accept when we notice that boy's in the same position is elsewhere called class 1. (S.E. p.118).

Group B. This has been well treated by James Sledd in his review of S.E.¹ He has pointed out the variety of words which may enter the frame provided and which are yet

not given the same group name.

Arbitrariness of selection is further illustrated by the fact that the frame

A	1	B	2
<u>The</u>	-	-	<u>move</u>
		<u>had to</u>	
		<u>did</u>	

will not include other words of the same group (had, was, got, kept), and that it will include a + ly. Fries should make it clear that it is inflectional characteristics which basically exclude a + ly from group B, and that the studies of the positional uses of the words are here incidental.

Other cases of empirical error are apparently caused more by haste than by any fundamental dichotomy of views. Thus should is treated as a class 2 word (S.E.pp.162-3) and also as a function word, (S.E. p.150, p.166), in the one position. (The same applies to which and who as class 1 (S.E. p.214), and which as group J (S.E. p.101)).

Groups C and E. Though a structural meaning difference could justify the separation of not as in C from other uses, the frame for group E allows it to occur in exactly the same position as for E. This could easily be altered.

It is more serious that in group E not and but for example will not enter all the positions given for and.

Why they should all be grouped together is explained neither by meaning analysis nor by positional tests. It would have been preferable to select a diagnostic frame in which it is true that for all members "they stand between words of the same part-of-speech class of subgroup". (S.E.p.95).

Group D. We may be provided here with some major illustrations.

Since "Most of these same words also fill a similar position for class 4 words" (S.E. P.93), the differentiation of D from 4 must rely upon a meaning characteristic.

"All these words of Group D are attached to Class 3 words and in spite of differences between them and without any connection with their lexical meanings in other positions, all signal some degree or quantity of the 'quality' for which the Class 3 word stands." (S.E. p.93).

But when we come to examine class 4 we find that words like singly or sufficiently satisfy the same meaning demand. An investigation of group D and class 4 by Paul Roberts² suggests a re-classification based on his more thorough distributional analysis. Fries himself is aware that more work needs to be done (S.E. p.91, footnote 4), but does not fully appreciate that even introductory analysis will show that group D is not well founded.

Roberts can permit subdivision and variation within a group of words linked by a common environment because he

considers that the structural meanings of words in unique positions carry over into the positions where they commonly occur. This tends of course to suggest a denial of a structural meaning value for the position in which words occur commonly (eg. n/a in The -- v + o the n + o.) But it is of value in pointing out that words which occupy unique positions and which also occur in common positions, may have different transformations in the last case, and that this difference in meaning is structural and not lexical. (See 5.33 on transformations).

However, as Fries' group D now stands, there is some opportunity for saying that the words listed as members do not necessarily satisfy a structural meaning characteristic, but a lexical one. For instance, always, later, and sometimes, may occupy the test for group D words, and are yet excluded by a meaning criterion which it is difficult to call structural. (On the other hand away is permitted as a group D word, though it does not have the meaning required (S.E. p.93)).

The analysis of positional distribution may again be shown at fault, when it is noted that much and rather are made members of one group. We may read much coal but never rather coal, I rather hope that but not I much hope that. If these differences are to be treated as subdivisions of group D, then they should be recorded, for they frequently occur.

Group F. The members are automatically given a sameness of structural meaning which it is not always easy to find. Though the positional arrangements in the next two examples are the same, (a) the men of the castle, (b) the men at the castle, the structural meanings seem different because (a) can be translated the castle men whereas (b) can not. It is very difficult to decide where the limits of 'sameness' and 'difference' begin and end.

As a further example, we may note that words the same as those in group F can be called class 4 or group F after v in 2 - A 1 (S.E. p. 84, p. 139, p.268) but only group F after B E in are - A 1 (S.E. p. 95).

Again, what are the members of group F to be called when they appear as follows: after walking, in thinking, through writing, without staying, etc.

Group G. Though do is selected as the unique member, it must be recognized that will, shall, have and the old "auxiliaries" will occur in the same frames. Yet once again there is no reason for the isolation except some kind of meaning assumption.

Group I. The following quote makes it clear that the generally claimed positional analysis is set aside in favour of inflectional and meaning considerations.
(Similar remarks apply to group H.)

"In the positions shown above, in single free utterance units, they [the members] operate as signals of question sentences. Some of them (who, which, what) occur also in the positions of class 1 words. In the positions of class 1 words their signal of 'question sentence' supercedes that of the form-class arrangement." (S.E. p.99).

On the positional level it is also difficult to understand why who, which and where are put in group I, without any sub-classification, for they occupy positions which are structurally very different from the other members, that is, when they help to form expansions of a noun or a noun sequence.

These remarks provide a good illustration of the view that it is not true to say that words which occupy the same set of positions belong to the same part of speech.

Group J. The procedures used to establish group J may be conveniently compared with procedures elsewhere, as a final example of inconsistency.

Group J is a name for words such as and, when, but, because, although, in one selected position. When some of these words appear in other positions they may be given a different title. For example and and but appear as group E, where and when as group I. Consequently they

are members of different classes, depending on the positions they occupy.

Class 1 on the other hand is a name for words which may enter not only a limited range of selected diagnostic positions, but as we have seen, a number of others as well. The positions here cease to be indicative of individual parts of speech or structural units, and are grouped together. The reason for the change in practice should be justified by some kind of meaning decision but none is given.

4.22 The whole situation has apparently developed because the positional uses of words have been bound up with inflectional. There is a class of words similar to class 1 which is defined by a certain range of inflections which appear in a variety of positions with different structural meanings. The function words, however, are not characterized by any inflectional range, and must be listed solely according to the positions they occupy. The treatment of their positional uses by Fries can be considered as a series of suggestions for empirical research.

The basic feature of the work is that the rules of occurrence for not - n . v. a words have been examined in a cursory way for only a limited number of their positions in a limited number of the sentences pl n. It is true that the selected positions account for uses which are

statistically very frequent, and may help in the establishment of formation rules for basic sentence types. It is also true that Fries considers his work introductory. But we have seen that the failure to record other occurrences has led to a considerable degree of descriptive error.

In many sentences we may come across instances where it is difficult to give a syntactic name to some words because their non-test frame positions have been given insufficient attention. These may also be of statistically high frequency. For example, if we replace good in the test frame for group D (S.E. p.92) by v+ing or even n+o, we will find that only some of the group D words will fit here. Is this sub-group still to be called group D, or are we to consider that the frame is entirely different from the original? Consider also It was not real, I believe him really, He slept awfully. Are the last words in these sentences to be treated as group D, or, as Roberts has suggested, should they be re-classified?

If members of group F can be called class 4 when they appear in a class 3 diagnostic position, as in the above discussion (S.E. p. 216, footnote 11) there seems little hope of arriving at a solution.

Compare also the following practices:

- (a) It really can't be that small (S.E. p. 234).

1 3

- (b) The non-underlined words are treated as group F in the following cases, where they do not appear in F test frames, but in positions which include diagnostic frames for class 4.

In many ways Bob is very much like his brother.

The materials will be ready along about February.

The path was planned to go right between the posts.

(Compare The men went down rapidly often. The last three words are all class 4 on page 85).

Our paper had fallen just over the wall.

That vine has grown rapidly right up the side of the house.

We used to plow it almost to the fence.

(All from page 238)

His footprints were very clear directly beneath the window.

Mr. F - built not far up the road from us

(Both from S.E. p. 239)

- (c) Again, compare the refusal to accept the bound form characteristics of Chapter VII as necessary for the definition of a class in

My professor spent his holiday that way (S.E. p.194).

All these examples make it very difficult for us to know how to treat the non-underlined words in sentences like the following:

- (a) I gave her\$ to the boy (where her\$ is in a class 1 position).
- (b) The children's constant deafening racket kept the younger ones from sleeping. (S.E. p.211).
- (c) The men listed in the order sheet were all they needed.
The men listed in the order sheet all they needed.
The students nominated for the committee were all their friends. (All from S.E. p.216).
- (d) That amount is just about what we figured. (S.E.p.246).

It is preferable to state the rules of occurrence for each of the positions of the sentences p1 n, difficult though this might be without the assistance of machine methods of analysis. However, the number of function words or small class positions must be limited, and the number of individual words to be treated is limited to a comparatively small set.

4.3 Alternative Theory about Function Words.

4.31 The problem of the difference between the function words and the members of the classes may be linked with the problem of the difference in logic between a syntactic constant or logical sign, and a member of a variable.

Fries maintains that the distinctive feature of a function word is that it carries structural meaning within itself, isolated from any formal appendage. But this is not exclusive to function words, for it is true of many words which are members of either the noun or verb class eg, that they can be listed in isolation as either n+o or v+o, and will be recognizable as members of their syntactic classes. For example, woman, cardigan, spectacle; think, behave, tolerate.

Logicians, however, have also tended merely to list the logical signs without being able to solve how they are different from the values of the variables.³

It may be put forward that the essential characteristic of the function words is that they are limited groups of individual free forms for which no other outside words can substitute to create a particular arrangement of syntactic units for a sentence of a given positional length. It may be that in other types of sentences they will not even

substitute for one another, but must be listed separately. Put in another way, a morpheme or group of morphemes may be considered a logical constant or logical class, if the substitution of any other morphemes will break the rules of sentence formation in at least one instance.

We may define as logical any symbol which represents a class of single morpheme elements (which may be a class of one member and thus a constant) which all have one or more positional features in common in order to create a sentence. (See 7.4).

4.32 The theory would demand a set of function word groups somewhat different from the ones Fries establishes. Not all the subdivisions of the 154 words he recognizes, for example, in the particular sentence types examined, exclude substitution of their values by words outside of each group. Nevertheless, since it will be found that for various frames various re-groupings will have to be made, or that some words which are at one time special values of a class, will be constants at others, there is at least a good deal of truth in his remark that the function words must be remembered as items. (See 7.4). The classes 1 to 4, or the variables n, v, a, etc, on the other hand, allow of a wide variety of substitutions; that is, they have very large numbers of values which do not have to be held in mind in relation to structures.

Although function words can be put into Fries' groups, individual members of a group may occur only with certain lexical items. For example, various prepositions, or the pronouns who and which, are linked with different meaning ranges of the nouns. The subdivisions of a group which may consequently be created will be called semantic if it is true that when any of the members is used in any given frame, it does not alter the occurrence of the syntactic elements, but relates only to the values of the variables. Thus in

The n+s v+d the n+o -- v+s a+ly
who and which will fill the same syntactic frame; whereas the and some, than and as, must be treated either as four separate constants or values of four separate groups (depending on fuller study) because we find

Some v+o a+ly but not The v+o a+ly
 and The n+o is a+er than the n+o
 but not The n+o is a+er as the n+o

4.33 It is now possible to treat Fries' view that "In the words of our fifteen groups it is usually difficult if not impossible to indicate a lexical meaning apart from the structural meaning which these words signal." (S.E. p. 106).

It may be said that if the words belong to a group then they will at least have the meaning characteristics of

the frame in which they are used, and if they are individual constants, then there is no need to try to separate their logical from their structural meaning. As constants, they may be called autonomous symbols of the metalanguage (Carnap's terminology), whose descriptive or semantic content is automatically carried into the syntax by the necessity of retaining the object language words as syntactic constants. (See 21/12.)

Although there is some difference of opinion with Fries about the nature and classification of the function words, it should be recognized that his work has been valuable in pointing out their importance in the structure of English sentences, and that his stress upon their structural meanings as individual items, hedges towards the attitude adopted here.

¹ Sledd, James, a review of S.E., Language, 31 (1955), p.343.

² Roberts, Paul, "Fries's Group D", Language, 31 (1955), pages 20-24.

³ (a) Quine, W. van O., Methods of Logic, (London, Routledge and Kegan Paul, 1952), p.xv.

Elementary Logic, (Boston, Ginn and Co., (The Athenaeum Press) 1941), p.1.

Mathematical Logic, (Revised edition, Cambridge, U.S.A., Harvard University Press, 1951), p.1, p.2 compared with p.6.

- ³ (b) Reichenbach, Hans, Elements of Symbolic Logic, (New York, MacMillan, 1947), p.318 foll. (discussed in a later chapter of this paper.)
- (c) Russell, Bertrand, Human Knowledge. Its Scope and Limits, (London, Allen and Unwin, 1948), p.136, pp.269-270.
- (d) Tarski, Alfred, Introduction to Logic, (2nd edn. New York Oxford University Press, 1949) pages 3-4, p.18.
- (e) Carnap, Rudolf, Introduction to Semantics, (Cambridge, Massachusetts, Harvard University Press, 1942) pages 56-9.

CHAPTER 5.

BASIC SENTENCE TYPES AND IMMEDIATE CONSTITUENTS.

5.0 Introduction.

Some ideas will be developed here upon how to define, and also how to discover, immediate constituents, which are rather different to those of Fries and other linguists. This is because we require answers to some important problems which have been difficult to handle. It is hoped that the theories below will be of use in setting up formation rules, or in other words, a series of I C's to be used on basic sentence types in order to generate other sentences.

The study of equivalences and of sentence boundary has been stressed, and reference has been made to the problem of dealing with structures which have more than one meaning interpretation. The suggestion is made that structural meanings of I C's can be defined by equivalent forms, although the various possible analyses of I C's have also been pointed out.

In the work of Fries the identification of particular I C sequences is not always clear; and

although he gives some valuable information about sequence sentences, he does not take quite the same view as here of basic sentence types as an initial set for the development of a strict calculus. Consequently it is a little difficult to follow what sentences he would like us to use initially.

5.1 Basis for the Review.

5.11 Once the word classes and constants of a language have been established, it is possible to examine their arrangements in sentences and find the rules of occurrence which are not part of their defining characteristics. Thus formation rules for the various sentences may be stated and the sentence types of the language recorded. It is also possible to find out what syntactic sequences will substitute for one or more syntactic elements in any given sentence frame, so that, with suitable rules of substitution, we may state a basic set of sentences from which the others may be generated.

This last type of analysis turns upon the study of sentences when broken up into sequential units generally known as immediate constituents. It is a commonly used method of providing the structure of English, and links with the treatment of certain sequences as groups whose structural relationships with other parts of a sentence are defined by the group only as a whole, with one word acting as the diagnostic head.

5.12 However, the diversity of substitution

units which may be selected in written language has not been very well realized, nor has it been more than rarely considered that there may be a consequent variation in the types of sentences which are selected as basic. For example, if a sentence is always to be cut into two units as in Fries' system of I C analysis, we will have a different set of initial sentences and formation rules to one which accepts a three-part or even four part cut for some sentences, and consequently allows sentence types previously generated by the rules to be placed among the initial set.

But it is always essential either through the rules or the initial set, to provide a means of establishing at least the most commonly found sentences. Thus it is useful to accept in the initial set at least the three different basic sentence types recorded by Fries (question, request and statement), rather than to try to generate one from the other in a complex and unwieldy fashion. It may also be useful to record quite a lot more, depending on the complexity of the rules which would be necessary to generate the rest. Some frequently found sentences, though basic in the sense that they are very common, may not be so useful as others, because rules for the development of the remainder from them may become confused, due to requirements of switching word order and so on. For example, in spoken utterances some sentences without either the usual and or or may be frequent, but they

may not be useful as basic sentence types.

It may be found that there is a particular set of I C rules which may be selected from the possibilities of substitution which are the ones which the speakers of a language use. Intonation and stress patterns, meaning transformation rules, the occurrence of possible sentence boundaries within a sentence, and so on, may provide the means by which we determine what set most fully reflects the structural arrangements of the language in use. But the meaning assumption of a two part cut for all sentences and all I C's, as in Fries and others, which probably follows on traditionally from the older subject + predicate analysis, is not necessarily correct.

These remarks may be considered as an introduction to the more particular study of Fries which follows. Immediate constituents will receive closer attention in a later section.

5.2 Subjects and Objects.

5.21 These are treated as I C's whose members are recognizable as single word units in basic sentence types or as sequences in expanded sentence types. (S.E. p.175ff, p.267ff). Traditional meaning definitions are dismissed, and the claim is made that "we have tried here first to find formal characteristics by which to identify each functioning unit and structure..." (S.E.p.175). This holds fairly true for the differen-

tiation of subjects and objects as single words from other structural units, but it is not always true for the subdivisions within the two I C's, nor, as it will be seen in the section on modifiers, for the units as sequences.

Extensive use is made of the principle of analysing by 'same' or 'different' meaning response, so that in practical results there is very little difference between this method, and one of assuming some meaning characteristic for a unit as in traditional grammar, and then supplying forms which carry the meaning. The units which are considered by Fries to have the same or different meaning need not always be considered so by others.

5.22 The subdivision of the structural unit called 'subject' into five different meaning categories, allied to five different forms, provides a deal of criticism. It may easily be seen that the formal differentiations are inadequate and that meaning problems result.

The confusions of meaning may be taken first:

(a) In the form given in the example One difficulty is the size of the trees, the 'subject', i.e. the noun phrase preceding the verb, is called 'that which is identified'. But this same meaning will apply to the noun phrase after the verb (as Fries would possibly admit).

(b) None of the five meanings seem to fit the 'subject' of the following two sentences taken from examples S.E.p.176:

"The giving of the money to the boy by the man occurred yesterday."

"Yesterday was the time of the giving of the money to the boy by the man."

(c) Consider also: "The examination takes a full two hours." (S.E.p.179). The form of this example is supposed to indicate the meaning of 'performer' for the 'subject.' The same is claimed for "The material you sent won't do at all." Why can it not be considered that material is 'described,' and will therefore fit another meaning category?

The meanings which are provided for structural units do not necessarily apply.

More important theoretically are the differentiations of the five categories of 'subject' according to form. The following points of criticism arise:

(a) The formal characteristics of the meaning class 'that to or for which the action is performed' as in, e.g., The boy was given the bat by John are not clear. For example, is the subject of The bat was used by John a member of this class?

(b) The division between (b) and (c) categories (S.E. p.179) also appears arbitrary. For example, the sentence He is the man in the garden formally

satisfies both. (And on the meaning level, the¹²⁹ 'subject' can be said to be both 'identified' and described').

(c) The sentences of S.E. p.135 may be compared with (c) category ('that which is described'). They have the formal characteristics of (c), but have some similarity with (a) examples on S.E. p.179, where the 'subject' is 'performer'. The (a) sentence Some bread toasts better than others also has all the formal characteristics of (c).

(A major cause of confusion is that Fries is not clear about what constitutes the class of 2B verbs (S.E. p.189).)

(d) Finally, some examples of ambiguity of meaning are remarked.(S.E. pages 180 foll.). However, for these forms, only one verb, give, is supplied. O----- was elected Sheriff and The laundry was taken off the line are both unambiguous, though with the same form as examples of ambiguity listed by Fries. It is consequently suggested that the ambiguity occurs only with the one or few verbs.

5.23 For the identification of an object structure, we are provided with clear enough examples in commonly found sentences (S.E. pp.192-3). But general characteristics for the definition of 'object' or any of its subdivisions are not adequate. F.W.Harwood in unpublished material has considered that a direct

object structure can be defined by its ability to take a certain passive conversion. It can be added that definitions of indirect object may also draw upon other formal features of the passive conversion and have done so in the past.

For example: The boy gave / the man / the money.
 = The money was given / to the man / by the boy.

Such considerations would appear to be of greater value than a mere listing of acceptable sentence types. This is especially true because the meaning which Fries applies to the examples of indirect object forms is 'that to or for which an action is performed.' (S.E. p.185) It will also apply to other structures, as he would be ready to admit. For example, I made it to put on the box, I made it for my dress.

A footnote (S.E. p.185) insists that the indirect object occurs in the form The man gave the boy the money, and not in The man gave the money to the boy. Nevertheless, they both take the conversion The boy was given the money by the man, which indicates a structural similarity. To insist on a distinction between them is rather like insisting that a noun before a passive verb construction is not a subject, because of the use of the auxiliary was or is.

Conversion possibilities are also important because they can differentiate objects, adverbial objects, and etc. from indirect forms.

For example: The man gave the money to the boy.

= The man gave the boy the money.

= The boy was given the money by the man
etc.

But, The man led the horse to the hill

The dog knocked the vase with the flowers

The boys made the race six miles

do not have the same equivalences.

Another type of confusion may occur as a result of the lack of information about adverbial objects in Fries' work. So far as it is possible to tell, their selection depends only upon meaning characteristics (S.E. p.186). And these meanings do not exclude such diverse forms as The men approved the suggestion /
as social, (compare examples/^{S.E.}p.194) and The matter ended / the week (compare The matter will probably come up / this week on S.E. p.186). However the use of the substitute groups as meaning characteristics for various objects (S.E. p.194 foll.) could be justified formally if we could consider them as syntactic constants, occurring in particular positions and forcing subdivisions upon the class of n.

Finally the treatment of the non-object constructions after the verb (S.E. pp. 187-8) overlooks some necessary formal features in description of the examples in order to keep them as a separate group. For instance, the noun adjunct construction needs to have its differences from an indirect + direct object construction recorded, and a predicative nominative needs to be distinguished by its use of a particular class of verbs.

5.3 Modifiers.

5.31 In the chapter on modifiers

"We must begin with the understanding that 'modification' is a structure and that, like all structures, it must be described in terms of the formal units of which it is composed and the characteristic arrangements of these units." (S.E.p.204)

We see that there is a large variety of forms which are called 'modifiers' in the chapter which follows. A definition applicable to all is provided (S.E. p.227): it is a construction which can be placed as a whole, where its part the 'head' may be placed. Nevertheless, this is not complete, because we have to be able to identify a 'head'. For example, would it be considered that because in John came to town quickly we can place quickly for an appointment in the position of quickly, that the phrase includes modification? This is

left open. The test of sameness or difference of response is scarcely helpful. Just how we can tell, or how an informant can tell us that The tall dark man in the green suit was here, is structurally equivalent on a meaning base to The man was here, while the questionable substitution above will not have the same structural meaning as quickly is not at all clear.

The problem of how to recognize a 'head' becomes even more acute when it is observed that structures listed (S.E. p.229) do not seem to fit the definition at all, but seem to have obscure meaning bases for their inclusion. When it is said that objects may by choice be considered modifiers of a verb or otherwise (S.E. p.228) there is really an admission of some formal confusion. However, the inclusion or exclusion of objects as modifiers of a verb is serious for I C's.

Now, "The meanings in the structure of modification...vary widely, but the specific differences of meaning in this variety are on the whole tied to the formal make-up of the modification structure." (S.E. p.239)

Since the identification of modification is to be 'on the whole' through formal make-up, and since formal make-up appears to be the characteristic that a sequence of morphemes may be substituted for one of its parts,

how far should this last characteristic be allowed to run across the language? Should it extend to include 'objects' for instance or not? Should it extend to other structures? It is possible to consider all structures longer than the basic class 1 + class 2 sentences as structures of modification of these two word classes?

As Fries mentions no other meaning characteristic than the one based on 'head', this activity can not be excluded and the meanings for specific cases may be replaced by others. Consequently there is no reason why the stroke enclosed sections in the following examples from the book cannot replace the words that, how and dinner as their respective heads.

In / the layout of the bed I think that / you
should stay away from the willow tree.

/HowJ- got elected to that job / none of us
ever found out.

/Whatever you decide to do about the dinner / will
be alright with us.

Features of spoken language can of course put limits on what sort of units we will select for some sentences. But they need not always apply in a written text, and in any case may be discarded if the resulting substitution system has a good fit.

(See 9.2 foll.)¹

5.32 In summary then, the reason for the inclusion of some forms as modifiers and the exclusion of others is not at all clear, and practice appears to be based on arbitrary ruling.

Some difficulties of practical analysis arising from Fries' definition of a modifier construction are now to be considered. The first concerns class 1. The second begins with class 1 but is found to extend further and to have considerable importance.

(a) It is said that a class 1 word together with any type of modifier construction "can be substituted in any 'position' in which a class 1 word alone can appear." (S.E.p.213) Because a class 1 word can appear within a modifier, for instance as a noun adjunct, this general statement is scarcely true. (See examples S.E.p.211 and p.212) Z. S. Harris, indeed, found it necessary to try to restrict the positions in which a head + modifier could replace a head word.²

(b) Difficulties which are of more general significance begin with combinations of group F. and class 1. It is claimed (S.E. p.211) that when an F + 1 appears after another class 1, the group modifies this word. But there are a large number of occasions when the theory does not hold.

Let us take a sentence with an indirect object:
He gave the book to the boy. Even if, like Fries, we

do not permit to the boy as an indirect object, there is no reason why we should call it a modifier. It may be better not to call it a modifier either of a noun or a verb at all, but to keep it as a separate I C, because of the indirect object conversions where it is manipulated into various positions.

5.33 The biggest problems arise, however, when we take some other constructions of prepositions after the verb. It is considered by Fries that sequences of the kind The money for the milkman, a dog in the next apartment, a man from the F.B.I., receptions for the new members, all include modifiers of the first class 1 words. But this is not always the case. Some examples are provided below where the combination of a preposition and a noun may create a modifier of either a noun or a verb, or be ambiguous, or have yet other features about it.

Verb modifiers: He put the dog / in the garden /
He placed the razor / to his face /
They began the conference / at the end
on Wednesday /

Noun modifiers: The women did the voluntary work / of
the hospital /
We will find the books / from the library /
I like the child / with the fair hair /
 (of probably provides noun modifiers
 in this construction consistently)

Cases of ambiguous
modifier meaning:

I rode the horse / on the hill /
I worked the tractor / from the barn /
We helped the man / with the case /
I like the dog / in the next
apartment /

Ambiguous cases where
no difference in
meaning relation-
ship results:

I found the children / on the lawn /
I saw a dog / in the next apartment /

Ambiguous case where
the F+1 sequence may
not only modify either
the verb or the noun
but also be treated in
a way, ^{at least} rather similar to
an indirect object:

I left the money / for the milkman /

This can take three different
conversions:

I left the milkman the money

The money for the milkman was left
(i.e. behind) by me.

I left the money for (i.e. to go
with) the milkman.

The conversions of the ambiguous cases are unknown,
and it must be admitted that the sentences provide insuf-
ficient meaning knowledge. This may be considered due to
the structure, or to the unidentified range of meanings of
individual prepositions, or perhaps nouns and verbs as well,
or it may be considered due to both lexical and structural
features. It is hard to say at present whether the ambiguities and

non-ambiguities are due to syntax or semantics, but with adequate investigation of distribution it may be possible to decide this question.

We hope that by keeping the definitions of a logical class and a logical constant in mind there will be opportunity for future studies to rectify existing ignorance. Thus for example when we meet a sentence where we have apparently one syntactic class whose values have different meaning conversions, we can ask whether it can really be broken up into more. If we take (a) We liked the child with the brown hair and (b) We helped the man with the brown case it may be thought that help and like belong to the same syntactic unit. But if an examination of their occurrences in other sentences is made, it could perhaps be shown that the classification is not correct.

Consider (a)

= (1) The child with the brown hair was liked by us

and ≠ (2) The child was liked with the brown hair by us

(b)

= (1) The man with the brown case was helped by us

or = (2) The man was helped with the brown case by us

This could mean that because of the difference in occurrence of help and like before with, the two

verbs belong to two different syntactic classes, and that consequently (a) and (b) can not be said to be exactly the same in structure. Their sequences which Fries calls modifiers would have to be differentiated by distributional criteria.

The fact that meaning equivalences were used to illustrate the point is irrelevant, being merely a matter of convenience. The same point about possible difference in structure could be illustrated by taking other sentences which are not equivalent.

But no decision can be made that a difference in occurrence is syntactic, until we see put into practice the procedures outlined in 7.4. It could be semantic. An exhaustive analysis of the positional occurrence of morphemes in the given sentences may merely indicate a difference in the uses of class values.³

5.34 In either case, whether the difference is semantic or syntactic, it is claimed that distributional analysis is not to be criticized for overlooking meaning patterns. It can proceed quite validly in order to find an accurate record of the sentence orders of English. We can show as in the previous examples, whether sentences which appear to include the same structural elements, do not, merely by examining other sentences.

If it is found that questions of ambiguity and non-ambiguity are semantic, then no criticism of distribution for ignoring meaning can apply. It could be that the problem of what modifies what in some examples in 5.33 is independent of syntax. If on the other hand the ambiguity or otherwise is found to be syntactic then all that we need do is admit it as a feature of the structure of the language, and include it in the rules.

When information is desired of a syntactic meaning kind about how a noun relates to a verb when it occurs before the verb or after, or about the relationship of a class of prepositions to a class of nouns and so on, we can combine our knowledge of distributionally defined minimal units with studies of equivalence. Meaning relationships can be discovered when we wish. It will be seen how this combined study might enable us to provide a means of cutting sentences into sequential units or I C's so that the meaning structure of the language at a higher level is retained. For although a purely distributional analysis of sequential units of classes and constants can provide accurate rules for structuring a language, it need not reflect the I C meanings the users accept. This is the limitation of it.

So, taking the two sentences

(a) The man/gave/the money/to the children

and (b) The man/put/the razor/to his face

it could firstly be found that

(c) The man/gave/the children/the money

will occur, while

(d) The man/put/his face/the razor will not.

It is likely that we would then find that put and gave belong to two different syntactic classes. Then secondly, it could be found that (a) and (c) are equivalent, and that (b) is equivalent to

(e) The razor/was put/to his face/by the man

The I Cs(indicated by the line cuts) follow, with their meanings expressed through the equivalences.

5.35 With regard to the structure of the examples in 5.33, particular attention needs to be given to the occurrences of prepositions, and how these relate to ambiguities when certain verbs are involved, or when certain nouns are involved after the verbs and prepositions, and so on. Investigation might show that varying lexical meanings are more important for some cases than for others. Thus for and to would have to be considered especially in sequences similar to direct objects.

I fixed the reception for the members

= (a) I fixed the members with the reception

or = (b) The reception for the members was fixed by me

In other sequences, when for example for occurs with left as in I left the money for the milkman, the meaning

of the verb may be important.

Fries himself does not consider that his own work is any more than a broad outline, and says that all problems are not solved. (S.E.p.217, fn.12). It may be seen now that his discussion of modifiers really provides him with formation rules or I C's to create longer sentences out of smaller (S.E. p.241), or to reduce larger sentences to basic types. (S.E. Chapter VIII. See pages 267-8) But it leaves us with difficulty in applying the rules in either case. Consequently there has been emphasis upon the formal analysis of the modifiers, with no attention paid to the meanings he supplies for them. Meaning study has been considered subsidiary because no positional meaning can be conveyed unless there are positions to convey it.

5.4 The Immediate Constituent System.

In the Chapter headed "Immediate Constituents" a fuller system for the subdivision of sentences is developed, drawing upon the units which have just been discussed here.

Rules for the subdivision of sentences into groups of word classes and constants are treated first. Then these units are themselves broken up layer after layer to show the possibilities of substitution within them. A system of rules is consequently

supplied for reducing the morpheme composition of sentences to basic types of construction.

In this manner:

The little children like the bird sent

The primary 1 6 divisions and the subsequent layout of break-down within them are, however, given a structural meaning value (S.I. p.262).

The reason for a primary two part cut for every sentence may be linked with traditional practice, but more importantly with Fries' own view that arrangements of class 1 and class 2 provide the basic signals of all English sentences. But why the two part division is still carried through every sub-unit is not explained.

Some of the questions which the boxed 1 6 analysis are complicated and the answers to them have not always been easy to find. We may take some cases. One is that there have been examples of subdivisions within noun expansions which can be assigned to analysis of distribution and thus be given syntactic meaning at one time, and yet be assigned to analysis of logical material at another. Another concerns the problem of the separation of a noun phrase into parts by methods like those used by Fries (S.I. pp. 265 - 6). For example, the division of the first sequence on p.266 requires an answer to why an should be considered as a lower

level than which is thorough, and to why the students is given a level common to an oral examination. An (S.E.p.266), is also on a level different to D in the formula for rule 8 (S.E. p.270). Although the procedure rule numbered 8 is applied on S.E. p.270, for some reason it is not used on the example on S.E. p.266.

Again, in problems of subdivision of verb expansions, it is hard to know for instance in the last illustration S.E.p.266, why here is not on the same level as always, since both words can be treated as ones which affect the whole sequence.

5.42 The formal clues for the particular cuts used are not clearly supplied, and so we may turn to the following principle:

"In general, the basic procedure of arriving at and testing significant features of structural grouping has been that of systematic substitution with enough control of meaning to decide whether any two arrangements were the 'same' or 'different', i.e. whether the 'response' of the native speaker was the 'same' or 'different'." (S.E. p.263)

But what is the difference of structural meaning between

	the		tall		dark		tree
and	the		dark		tall		tree

Why should rule 8 (S.E.p.267-8 and p.270) be applied without any further explanation? The position of a modifier after the and before a second modifier, should, if each sub-unit has a structural meaning, have a structural meaning which is different from that of the position of the second modifier. But in this case it has not. Both modifiers modify the head word but not one another.

However, in the very dark night there is a difference between the ~~first and second~~ modifier words of class 1 - not because of position itself, but because of word classes chosen to fill these positions. Rule 8 should not be applied consistently.

Some further difficulties are as follows:

- (a) S.E.p.269: It is not shown how we know that the group F words in formula 2 are tied to the following class 1 words. We have seen in 5.33 above that group F words may refer back to a class 2 word, and consequently ask how it is that we know that the last group F word in the formula modifies the following class 1 and not the preceding class 2.
- (b) S.E.p.270: The cuts separating the modifiers of the class 2 word in formula 9 are perhaps the most pronounced example of arbitrary ruling.

The break up of the units within the full attention of the students who stay in town, is different to that of the similar construction, an examination of the students who are here now on S.E. p.265.

- (c) S.E. p.272: What determines that salary should be on the same level as staff and on a lower level than for? The analysis could be right, but no reasons are given for it. Why are the two the's in The salary cheques for the staff on two different levels?

The rules of procedure do not justify the variation.

5.43 It becomes apparent that it is incorrect to say:

"In all of these various layers of structure the determination of the direction of the modification, the grasp of the precise units that form the immediate constituents of each structure, come as an automatic response to those who know the language. These groupings are not vague, but precise and sharp." (S.E. p.272)

It is true that the limits of some units commonly accepted by linguists, for instance subjects and their expansions, may be formally supplied. But linguists

also disagree whether the sequences which follow a verb as in cases like came slowly into the garden or knocked the chair, should be considered within the verb unit or not. This disagreement arises from (1) different theories of meaning, which lead to the establishment of different units, or (2) different formal rules of substitution, i.e. formation rules of the language, which vary according to the length of word groupings which a linguist allows to occur as substitution values of any word class or sequence. For example, The men came slowly down may match to The men/came, or to The men/came/slowly, as we wish.

It may be that a study of the transformation rules of the language could resolve some of the arbitrary nature of I C cutting. It could show the freedom or rigidity of manipulation of word groups, and reflect the meaning units to which users of a language are habituated.

For example:

The very old man came slowly into the garden

- = Into the garden / slowly / came / the very old man
- = Slowly / into the garden / came / the very old man
- = The very old man / came / into the garden / slowly
- = Slowly / the very old man / came / into the garden
- = Slowly / into the garden / the very old man / came
etc.

In this example, all equivalences show that certain word groups must always be treated as single units. Consequently the primary I C cutting of the original sentence is:

The very old man / came / slowly / into the garden

Its basic sentence type will consist of four units.

In other sentence forms we may get a different type of cutting. For example -

- The old man/ rang up/the woman/in the morning
 = The woman/was rung up/by the old man/in the morning
 = The woman/was rung up/in the morning/by the old man
 = In the morning/the woman/was rung up/by the old man

Here up can not be separated from rang in the passive forms, although there is an equivalent active form where the words occur apart.

The old man/rang/the woman/(up)/in the morning

Because this case still demands rang and up together in the passive, up can be treated as a sub-unit of rang and marked as above. (It may be that a special sub-class of verbs which combine inseparably with prepositions in the passive needs to be established).

Transformation rules may thus mark out what single classes (or constants) or combinations of classes and constants, may be manipulated into other positions to form a new sentence which will be referentially equivalent to the one in which they originally occurred.

Procedures like this may assist in stating the units which the users of a language do recognize, and then the structural meanings of these units may be supplied.

5.44 Another method for discovering the I C's recognized by speakers may be based on the knowledge that when larger sentences are developed from smaller, only certain groups of words will operate within the sentence to provide a new sentence boundary.

There is a matter in the introductory material on the formation rules of English (see 23.53) which may have an interesting relation to the purely linguistic transformation rules of English. It is possible to consider that the line cuts given in the introduction mark out major units of I C analysis because they mark out what units have to combine in order to form sentences. For example, a line cut after which would denote the end of a possible sentence, and would therefore be incorrect. It has to combine with other words which follow it, in order to form a new sentence from the one which precedes it.

Where relevant the cuts provided by transformation rules appear to compare closely with these. Although knowledge at present can not be fully certain because more detailed descriptive study is required, it is strongly suggested that both methods of cutting

could be used to set up basic I C's which may be less arbitrary than some of those previously used. They could provide units which are never set up through any outside theoretical imposition, whether of form or meaning, but which arise freely out of the form of the language itself. That would mean that many objections to previous I C analyses as invalid, because they do not reflect the way people use language, could be dismissed.

5.45 Once the actual formal units of the language structure are established, then there is a far better chance of establishing correct I C meanings.

Indeed "structural meanings" may be considered definable through transformations of the equivalence and implication kind. (Problems on S.E.pp.217-9 may perhaps be eventually cleared with the help of this view.)

Thus some new interpretation can be given to the remark that "all substitution procedures demand for their use the control of certain aspects of meaning. One cannot determine whether one item is substitutable for another in any frame without in some way knowing whether the result is 'same' or 'different.'" (S.E. p.294)

Despite this, when we are concerned solely with what groups of classes and constants will fill a given frame in order to make it a sentence, then no

meaning knowledge is required, and I C divisions may be made anywhere so long as the substitution theory which results creates acceptable sentence forms.

If, however, we are concerned with what meaning relationships certain groups have to other groups, then the study of equivalences is ~~importance~~ in order to exclude error. For this, meaning must enter to the extent of knowing what sentence forms are considered by the users of a language to be equivalent in referential content. Otherwise, none of the manipulations of the examples above may be considered.

The nature of syntactic transformations will be given closer attention later. It is more important now to state more precisely the nature of immediate constituents.

- 5.46 An I C may be defined for two cases,
- (a) It is any syntactic constant or word class or sequence of such units which will substitute for another syntactic constant or word class or sequence of such units in a given frame which is a partial sentence form, so that a complete sentence form is developed.
 - (b) It is any syntactic constant or word class or sequence of such units which will substitute for zero in a given frame which is a complete sentence form, so that a new sentence form is developed.

These instances of sentence types will illustrate:

- (a) The hungry children from the school / drank the milk
The stray cats /
Dogs /
They /
- (b) We held an examination / which was thorough
/ for the children
/ yesterday

It may be seen that a variety of I C subdivisions can be permitted, depending upon what substitution possibilities are selected. Sentence boundary, intonation patterns, stress and etc. could be used to limit them, and require full analysis. Transformation rules also may be used to modify the definition and enable us to choose one kind of subdivision rather than another through equivalent meanings. It may indeed be necessary to do so, in order to get a better fit than a non-meaning choice permits. (See 5.32 (b)).

Thus the structural meaning of which was thorough in the sentence -

We held an examination which was thorough
may be expressed through the equivalence -

We held a thorough examination

Fries' definition of a modifier (S.E.pp.227-8) compares with the definition of an I C given here, but there is an important point to be observed. It is insisted above that substitution possibilities are to be defined for each type of frame, whereas Fries tends

at times to suggest that a statement of substitution can be made for a head in any of its occurrences (S.E.pp.208-9, p.213). Nevertheless it is not certain that he holds this view (S.E. p.227). His meaning theories of 'sameness' or 'difference' of response could also include it in theory if not in practice. But it is fundamental not to omit the specification of the full environment in which the I C's hold as substitutes for one another. Harris has tended to give insufficient notice to this.

When the definition given in this paper is modified by the transformation theory, it may be compared with Fries' discussion of the nature of I C's (S.Epp.257-8). He likens them to units enclosed by brackets in mathematical formulas

$$(3 + 4) \times 6 = 42$$

$$\text{but } 3 + (4 \times 6) = 27$$

However, it is possible to vary I C groupings in English sentence types without any change of structural meaning in many cases. We have permitted various sub-divisions of the same syntactic orders above. Change of meaning comes frequently, not through variation in grouping or bracketing, but through shifting one group of symbols from one position to another.

Thus The men/came by/in the car/yesterday

= Yesterday/the men/came by/ in the car

but neither equals The men/in the car/came by/yesterday

The definition of sentence I C's may easily be adapted to treat I C's within I C's, until the individual morphemic units of sentences are reached.

5.5 Appendix: The Basic Sentence Types.

The basic sentences which can be considered members of an initial set on which formation rules are to operate are not fully clear (see 2.23), but the list below may be treated as a fair selection. One of the main purposes for their inclusion is to compare them later with those used by *Reichenbach*, in order to see whether logician and linguist differ and to find out who offers the most useful structural set.

Although there may be some points of obscurity in Fries' treatment of basic sentence types, he does present commonly found English sentences.

Those to be considered primarily are the three kinds of arrangement of Class 2 and Class 1, discovered through study of the types of response they elicit. ^{(S.E. p.413⁴⁴, p.144⁴⁴, p.263).}

class 1 \longleftrightarrow class 2 = statement

class 2 \longleftrightarrow class 1 = question

class 2 (class 1) = request (S.E. p.148)

Some comment immediately needs to be made. The statement type is far more frequent in written informative discourse, than the other two, and question is more frequent than request in similar material. Requests will consequently receive no further attention here.

The formalization of the three sentence types and remarks such as the following, call for some difference

in approach:

"...the four classes first identified account for all the significant positions of our minimum utterances. In fact classes 1 and 2 alone appear in many minimum free utterances. On the other hand the words of our fifteen groups appear most frequently in expanded single free utterances. As we shall see later, it is arrangements of class 1 and class 2 words that form the basic signals of our sentences. Only 'response' utterances not 'situation' utterances can have words from the fifteen groups of function words alone - without the words from the four classes." (S.E. pp. 105-6)

It needs to be remarked that function words are very important as structural signals in basic sentence types, as Fries' cases of ambiguity when they do not occur clearly show. (S.E. pp. 62-3). They cannot be ignored in the initial set, unless of course they are immediately placed in the formation rules. Fries has a tendency, however, to overlook ~~this~~ structural importance in general. A similar emphasis must be placed upon the structural importance of inflections as constants or small bound form groups.

Thus t n + o v + s a + o n + s can be compared with n + s v + o t a + o n + o

The various kinds of statement type sentence which Fries considers important now follow. We begin with the ten formulas which identify subjects as well as objects and other sequences which appear after the finite verb unit (S.E. p. 191 foll.) The notation provided in 1.1 is used. Some slight modification of Fries' word

It will be noticed above and below that not all alternate *inflections* in any position are listed. This is because only those alternate ones which Fries' formulas permit have been included. Thus, for example, when a past tense is used, Fries does not mark up the possibility of a present tense as well.

Whether the use of only three of these formulas as test frame for the diagnosis of word classes (S.E.p.75) and the I C theory that all sentences should be divided into two parts, make the rest expansions of class 1 \longleftrightarrow class 2 is not clear, but they may at least be accepted as commonly found sentence patterns.

Further examples of statement types are given in S.E. chapter VIII. These are apparently to be considered basic (S.E. p.40, p.53 fn.27), although they include much more than arrangements of class 1 and class 2, and some of them are said to be infrequent. (On the other hand, the ten formulas just listed are not described as basic sentence types.)

Three important forms have been added here, even though they may be held to be either special idiomatic constructions, or structures which vary little from those above (Eg. there in There is t n + s). As special forms they require further study in order to enable the words which appear in their positions to be classified into accurate classes and constants.

- (a) (not) ^{d^s} a^{ly} BE* (m³) n^{to} ^{m¹} v^{ts}
DO HAVE (t) n^{ts} v^{to}.....etc. (S.E. p.159).

Not often does he work.....

* The words with capital letters stand for all the variant forms of these verbs which can be selected for the particular case.

- (b) There BE (m³) n^{ts}
(t) n^{to}

There are the children (S.E. p.160)

- (c) were ^{m¹} v^{to}
r (t) n^{to} v^{ts} Z (S.E. p.163)
(m³) n^{ts}

Should they arrive we will have some food

Next come the special responses to utterances which differ from any situation utterances which can also occur as responses (S.E. p.165). They are mostly answers to questions and mainly occur in spoken language. But they are listed here very briefly because they could be extremely frequent in dialogue, and their forms have been quite rightly shown to be linked with those of preceding utterances (S.E. p.172). They have received insufficient attention in the past, and require more in the future. Reichenbach for example has given some attention to answers to questions which can be compared with Fries' work, and further developed. (See 17-71).

1. "For all questions in which the signal of the question is the 'reversal' of the basic class 1 and class 2 words, the answer usually contains the forms yes or no." (S.E.p.165).

A few other words with positive or negative meaning also occur here. All are frequently followed by substitutes as in

<u>Yes</u>	<u>it</u>	
<u>no</u>	<u>m^l</u>	v + s

But other forms normally incomplete as sentences also occur

e.g. yes

no a + ly.

2. "For questions with the function words who, which, what, whose, how, where, when, why, the answers may consist of practically any linguistic form of the single form-class fitting the particular type of question." (See S.E. p.167 foll. for the various answer forms which include sentence types not otherwise acceptable.)

The forms of questions now briefly follow. (See S.E. pages 96, 146 foll.):

- | | | | |
|----|------|----------------|----------------|
| | | m ^l | d ^s |
| | (t) | n + s | a + o |
| 1. | BE t | n + o | n + o ? |

Were the teachers here?

- | | | | |
|----|-------|----------------|---------|
| | | m ^l | |
| | (t) | n + s | |
| 2. | DO/ t | n + o | v + o ? |
| | /z | | |

Does the boy work?

3. HAVE (t) $\begin{matrix} t & n + o \\ n_1 + s \\ m \end{matrix}$ v + n ?

Has the customer paid?

4. Use of a limited list of words in the initial position followed by sentence patterns which vary a little from the usual statement types:

would, can, should, could, shall, will, may, must
(S.E. p.150)

E.g. $\begin{matrix} \text{will} & (t) & n + s & v + o & (t) & n + s & d^s \\ r & t & n_1 + o & v + s & t & n_1 + o & a + ly \\ & & m & & & m & \end{matrix}$

Should the men build the house here?

5. Use of who, which, what, whose, initially as in
 $\begin{matrix} v + s \\ \text{--- } v + o \dots \text{ etc.} \end{matrix}$

Who works?

(For questions, Fries recognizes the importance of function words, S.E. p.172).

Two more kinds of statements are 'sequence' sentences which occur after a speaker's or writer's initial sentence, and 'included' sentences. (S.E. p.241 foll.) The first differ from initial sentences in their use of certain function words, such as 'determiners' and 'adverbs' (and substitutes for class 1) (S.E. p.241). The included sentences make use of certain function words and particular features of word order (S.E. pp.252-3).

The two kinds ~~would~~ be reducible to basic sentence

types, but their special characteristics would have to be also recognized. Fries has done some valuable work in pointing them out in 'sequences'.

There are some notable exclusions of certain commonly found sentence types from the completed list. Statements of the kind which use the infinitive verb in conjunction with the finite verb, and those which use arrangements of verbs, nouns and propositions, as in some of the examples of modification problems we have discussed (5.33), *need* to be recognized either in an initial set or else through formation rules. The uses of the infinitive are not given any treatment in the book and occurrences of prepositions require further analysis.

¹ See also Harwood, F.W., "Axiomatic Syntax", Language, 31 (1955), pages 409-413.

² Harris, Zellig S., Methods in Structural Linguistics, (Chicago, University of Chicago Press, 1951), Chapter 16.

³ Compare Harris 16.33 in the work of ².

PART II.AN ANALYSIS OF WORK
BY ZELLIG S. HARRIS.CHAPTER 6.INTRODUCTION6.0 Introduction.

6.01 This part deals largely with "Morpheme to Utterance"¹ and sections of "Methods in Structural Linguistics"². The chapters in methods essentially involved are 1, and 15-20, because we are concerned only with classification of morphemes into syntactic units and with the sentence patterns of the units. (Chapters 12, 13 and 14 offer some reference.) However, the articles³ "From Phoneme to Morpheme", "Discourse Analysis", and "Discourse Analysis: A Sample Text" are related to the central discussion.

Methods and M.U. have been used to provide material for specific attention because they offered on publication original and highly important theories about language analysis. In the syntactic field they provided us with the opportunity of developing a rigorous and consistent discipline which has been the most important for English

since the work of Jespersen and Bloomfield.

They are considerably more important than the theories of Fries, because they strike more deeply and brilliantly into distributional problems, and because they are more fully aware of syntax as a strict metalanguage calculus. While it is true that the procedures outlined by Harris contain difficulties and inconsistencies, it is maintained that they can be largely overcome by developing further the distributional style of analysis and the calculus style of presentation which he recommends. It is for this reason that the work is of such importance. It is easier to find solutions to problems which arise in his work than it is to find them for problems which arise in the work of Fries or Reichenbach.

6.02 It is a humbling thought that the answer to criticisms about morpheme classification not only in Harris but also in Fries, follows along lines of formal distribution analysis. Thus, as a result of numbering morpheme positions, and examining substitution possibilities in each sentence of English with n position numbers, we can develop a way of separating syntactic material from semantic. In the same way, we can present a refined method of classifying morphemes into syntactic units which applies to any language and not only English.

It is true that Harris does not present the system of position numbering outlined here, but it can be easily developed from the distributional methods he presents. (For example see p. 353 Methods.) It is very interesting that in the independent field of the logical languages the same system of numbering follows directly out of Carnap's theories. (See 20.1 of this paper). It would consequently appear that general procedures for the analysis of both artificial and natural languages have been established, and that more could follow.

The particular procedure under discussion would be of considerable advantage in clearing up problems in "Discourse Analysis"³ where transformation material is neither clearly syntactic nor semantic, and where it is difficult to know just what manipulations are being made upon any text. Again, in Methods, Harris gives practically no attention to syntactic constants, although, as Fries was well aware, they are of considerable importance. It is hoped that the application of the procedure drawn from Carnap will give them definition.

The same procedure can also lead us into understanding that the presentation of syntactic information about classes and constants can be arbitrary. For example we can set up classes of syntactic classes, or classes of syntactic constants in various ways and know that they are

merely convenient manipulations. But at the same time, because of the rigorous nature of the examination of morphemes for the original identification of syntactic elements, we do not hold that it will allow these last to have alternatives. It is insisted that the procedures will always supply the same minimal syntactic units for any two investigators so long as the morphemes of a text have been identified by both in the same way. It is only the presentation of them which can differ. So we do not agree with critics who maintain that distributional analysis creates merely a structural imposition upon a language. Classification of morphemes into syntactic elements is non-arbitrary in this system.

6.03 However, it is not true for their sequence analysis that alternative units can not occur. Perhaps further analysis of formal signs such as sentence boundary and other features which occur in spoken language and bear upon written texts may one day be used to eliminate these. But the type of sequence substitution or immediate constituent cutting selected at present is not exclusive unless we impose restrictions which lie outside studies of distribution.

One restriction arises when we choose a set of basic sentence types to whose classes sequences in other sentences are always to be matched. (See 9.4 and 9.6).

Another arises when we use syntactic meaning equivalences by which to find sequences whose members are inseparable. (See 23.54).

It can be seen that Harris actually imposes a restriction of the first kind, and that how sentences are cut up into sequences is based on a decision to accept only one basic formula. Distribution studies may show that this one, N V, is essential in order to have an English sentence at all (cp. 2.1), and therefore it can be held that all other sentences may be compared with or reduced to it. But this is a decision which is not a necessary one in setting up the initial structures of a calculus upon which F R's are to operate.

Without a basic formula decision, and without a study of structural equivalences, many of the results of the application of Harris' theory about the substitution analysis of sequences need not be traditional. (This view contrasts with his own, Methods p.363). For many purposes, such arbitrary results, so long as consistent, may be all that is required. As an equivalence study draws on meaning as well as distribution, it goes beyond the style of procedures Harris puts forward.

For although he is varied in statement about what place meaning has in his methods, it becomes clear that his aim is to analyse both morpheme classes and class sequences

by distributional means alone. We have held that objections to this can be countered by the claim that distributional analysis of both classes and sequences can produce a useful record of the order patterns of syntactic units in a language. It is true that sequential meaning patterns can be overlooked (see 5.3 in the analysis of Fries), but this does not alter its value as an activity in its own right. In the establishment of logical classes and constants we can dismiss meaning objections completely because we hold that the procedures of 7.4 enable us to set up minimal syntactic units no matter whether we meet problems of equivalence or not. In sequential analysis of the units, however, a system which combines their distributional information with studies of syntactic equivalence is recommended because of the fuller knowledge it gives.

Some of the ideas about I C analysis in this paper will, it is hoped, be of use in solving difficulties about it. (See Methods, pages 272, 278-80, 306 and 363). For example, when Harris is faced with problems of ambiguity he answers them in a way not acceptable here. (See 8.4 and 5.3). It will be interesting to read his forthcoming publication on transformations which may make these comments obsolete.

6.04 In presentation of the material resulting from analysis, Harris has carried further the idea found in Jespersen, Fries and others, of creating an artificial language to express syntax. What he does is to make it more evident that the artificial language can be a calculus with basic sentence types upon which formation and transformation rules can operate by manipulation of the elements involved. Such a metalanguage is particularly valuable in view of possible machine uses of language for logical deduction, translation, and other purposes.

But while we are provided with original ideas and while the attempt to set up a calculus for English in Methods and M.U. is of great importance, the practice does not succeed. A main criticism is that the raised number notation system incorporates formation rules which are inaccurate. Another, is that the actual symbols consisting of the letters with the raised numbers, are so unwieldy and complex, that we can say they are overloaded in interpretation. Although Harris points out that his metalanguage is sketchy and needs refinement, it can also be held that it is too inaccurate to be useful. One of the major reasons for its failure is a theoretical tendency to overlook the variations in environment which members of a list of sequences can exhibit.

However, although the formation rules are inadequate,

a Harris type approach is preferable to a Reichenbach one. A Harris approach attempts to record distributional features extracted by rigorous methods; a Reichenbach approach is not sufficiently cognisant of syntactic material.

As remarked in the Survey of this paper (1: iv), it need not be necessary to present syntactic information in the way Harris does. We do not have to provide formation rules for sentences as broken into immediate constituents. Instead of choosing a set of basic sentence types which can be expanded through rules of sequence substitution into other sentences, we can simply set up a series of symbols and apply formation rules to them to create sentences as whole individual units. This may be more unwieldy than the first method, but useful for some purposes. Perhaps tests as to its accuracy could show that the statement of the syntactic order of elements in English is not dependant upon sequential cutting. (See 5.3, 7.4, 9.3 foll., and 21.12).

¹ Harris, Zellig S., "M.U." will be used throughout for convenient reference to "From Morpheme to Utterance", Language, 22 (1946) p.76 foll.

- ² Harris, Zellig S., Methods in Structural Linguistics, (Chicago, University of Chicago Press, 1951). "Methods" will be used throughout for convenient reference.
- ³ Harris, Zellig S., "From Phoneme to Morpheme", Language, 31 (1955), p.190 foll.
"Discourse Analysis", Language, 28 (1952), p.1 foll.
"Discourse Analysis: A Sample Text", Language, 28 (1952), p.474 foll.

CHAPTER 7.

SETTING-UP MORPHEME CLASSES:

SOME RE-CONSIDERATIONS

7.0 Introduction.

Although Harris presents theory on how to classify morphemes into classes which has had a considerable effect upon the development of structural studies, there are refinements needed which may eliminate some objections to it. This analysis of his work in *Methods* and *M.U.* aims to show that errors in theory and procedure can be eliminated largely by following along the lines of distributional analysis he suggests.

As a result, it is hoped that we may overcome a confusion of syntactic features with semantic, and that we may also provide a means of analysing the identified morphemes of a given text into classes in a more strictly distributional fashion.

Other problems arise from the tendency to retain the desire to classify together all morphemes which have the same total range of environments. A major effect is to lead Harris into theory about establishing classes with values whose defining environments are only approximately the same (*Methods*, 15.2, 15.5). It would have been better

to adhere consistently to the criterion in M.U. 4.1 "that for each class there are particular sentence positions which can be filled by any number of that class and by those alone."

Finally it will be found that bound forms, rather than free forms, actually provide Harris as well as Fries, with the criteria for defining the classes he establishes.

It needs to be noted for the discussion, that Harris, unlike Fries, uses bound forms among the environments which are to be used initially in setting up classes. The term 'environment' will consequently refer to a frame which includes either bound or free forms or both. It also needs to be remarked, that when reference is made to 'a range of inflections' or similar, the range includes a zero element.

7.1 General Discussion of the Method of Setting up Morpheme Classes.

7.11 In both Methods (Chapter 15) and M.U. it is pointed out that the members of a class are to be found through their ability to substitute for one another in certain given environments. Thus the environments become the defining characteristics of the classes.

This procedure is to replace any attempt to find groups of morphemes which all enter exactly the same range

of environments because such cases are not frequent (p.243 foll. Methods). Consequently Harris maintains that we should establish a general class where the morphemes have certain environments in common, and also sub-classes of the general class where it will be seen that selections of the same morphemes enter environments different to other selections. (Chapter 15, Methods).

Though a class is to be defined by a limited set of environments which hold for all members (Methods, p.250, M.U. p. 167), in fact this is not always so. In M.U. N is a general class which is said to occur "before plural -s or its alternants, or after the or adjectives: hotel, butter, gain, one, two." (p.167). We can see however that this is not quite correct, for classes separated by Harris from N can also be found after the and adjectives. (For example, other adjectives). Consequently -s is left as its unique characteristic.

We can deduce that for a class to be set up, it must contain at least one environment into which all its members may enter. All the class symbols may be treated as general classes established in such a way; various subdivisions of N and etc. may follow.

7.12 In accepting this general procedure, it is useful for us to stress the need to reject any tempting lists of morphemes as members of a class when not all of

them satisfy its environment. There is no necessity to include them if the sub-classes are adequately recognized, as it is believed they must be; and if a contrary principle were carried out to any extent, it could unnecessarily confuse a syntactic calculus.

So there is disagreement with the general tenor of some remarks in Methods (Chapter 15). For instance:

"In particular we could form for morphological analysis general classes containing all those classes which have a large part of their environments in common (eg. the general class 1 - 7 containing not only the morphemes which occur in They will -- but also the other morphemes of these classes)." (p. 251).

This and other references to approximation techniques (eg. Methods 15.2, 15.5) really involve a side issue not well related to fundamental procedures for syntactic analysis. Harris is a little confused because he has not differentiated semantic distribution from syntactic. In disregarding sub-groups he is really concerned with overcoming the differences in distribution of semantic groups of morphemes in order to show that syntactically they belong to the same class, and he offers various reasons why the semantic divisions should be ignored in order to arrive at the structure of sentences. At least it may be

supposed that he need not necessarily mean that syntactic sub-groups are to be disregarded.

It will be seen in 7.4 that syntactic description may be precise, and that there are reasons for considering semantic distribution quite separately.

7.13 A second type of confusion arises because Harris does not fully dismiss the initially discussed notion of seeking to establish classes which will show the same total range of environments for each morpheme. (Methods p.243-5, M.U. 3.2).

This is not only evident in the desire to establish general classes by using approximation techniques. It is evident in the failure to give sufficient stress to the basic process of analysing the occurrence of morphemes in relation to individual sentence structures (as in 7.4), while comparison of the occurrences of morphemes in various different sentences is favoured. The essential point is that according to what is held constant as a frame for substitution, the morpheme list will vary, and although it is true that some morphemes which differ in relation to particular environments will all be the same in relation to another, this can not permit us to establish a class which overlooks their differences in other sentences. Thus cut, blue and garden will all fit in the -- flower, but will not all fit in The boy -- the

flower, The boy is in the --, The boy is --. Other morphemes may fit the same free form sentence frames but not take the same sets of inflections.

Certainly, Harris does not recommend that we should ignore sub-classes and says that the differences may be important (Methods p.251). But it will be seen that one or two blind spots occur in procedural recommendations.

7.2 Larger and More Useful Classes. Alternative Analyses.

7.21 This section deals with Harris' views on what environments among those in which morphemes occur are to be held diagnostic of class membership.

"The element which occurs in a given class position [i.e. in a given environment] may be a morpheme which occurs also in various other class positions. We merely select those positions in which many morphemes occur and in terms of which we get the most convenient total description." (M.U. 6.1).

In Methods we are to aim for "the larger and morphologically more useful class" (p.250) rather than ~~for~~ the small class with varied environments.

Yet certain small classes of morphemes are recognized which may occupy an environment common to a large number of morphemes. P and R for example (as defined in

M.U. 4.1) are given separate status though they may have an environment common with morphemes classified differently. The general class G is also discarded in favour of N and V in Methods (p.257 for 27, p.296 for 70).

Consider the morphemes which substitute for one another in the following, when using the type of analysis recommended in Methods, appendix to 15.4:

The boy is	here
" " "	near
" " "	red
" " "	open
" " "	fast
" " "	Bill

There seems at first sight a traditional or meaning basis for the setting up of P which is outside any of the distributional procedures. Nevertheless, there may be formal reasons for recognizing P which are not pointed out in theory by Harris. (The fact that they do not occur in inflectional environments, and also that they have unique distributions in other important sentences may be significant).

7.22 At present we may study the point that, as Harris has said himself, the distributional studies he recommends allow for alternative analyses. (Methods p.2) It is suggested in this paper that alternative analyses

There is no reason why a purely distributional study should not establish new general classes for these environments. Very large numbers of morphemes will fit such frames.

The conclusion follows that Harris has picked out one or more environments as the markers of a class in preference to others, and that these particular environments rather than the absolute distributional procedures described in M.U. and Methods (Chapter 15) have determined what classes he establishes. Such features of occurrence as those noticed here for N, V, A, P, R and D, become included in the formation rules (ie. rules for morpheme sequence substitution) and the classes are defined by other means. The element of choice is quite permissible if the resulting system has a good fit on the language.

7.3 Remarks on the Characteristics Used by Harris to Define Classes.

7.31 It is possible now to turn to Harris' selection of morpheme environments for the definition of classes, and to show that in actual fact, if not in theory, bound forms play a primary part. Definitions of the class symbols, various entries and footnotes in Methods and M.U., and chapters 17 and 18 in Methods, make it clear that inflections and other bound forms are most important

in the description of the morpheme groups which he establishes.

In support of these claims we may draw not only upon 7.2, but upon an examination of particular passages taken from Methods (pp 255-6). They may be treated as parts of a blind spot which is elsewhere not apparent, and which may even be clarified by the help of remarks which Harris makes himself, and by some new ideas to be presented.

It is said in these passages that the common linguistic practice of matching morphemes according to environments shorter than the full sentence is not adequate. This is of course true, to a great extent at least. For example it is only when we examine certain sequences (which may often be a full sentence) that it becomes clear whether a particular morpheme belongs to the noun or verb class. Eg. in The road cut, cut may be v+n, v+d or n+o, depending on what follows. (It may be added here that Fries' theory of diversity of strike attempted to present such information).

But Harris totally rejects short environments, which turn out to be bound forms and certain immediate free forms, for the following reasons.

"If we select -ing as a diagnostic environment, we would get a class containing do, have, see, etc.,

but not certain. If we select un- as the environment, we obtain a class with do, certain, etc., but not have, and with see only if -en or -ing follow. We could obtain many different classifications of the same morphemes." (p.256)

We may hold that such arguments are not valid because Harris' own system permits the very same kind of features, that is, an environment which is common to a large number of morphemes, with subdivisions of that environmental class. What is even more remarkable is that the class symbols in Methods and M.U. generally exemplify a short environment classificatory system.

The text goes on (p.256):

"These different classifications [i.e. groupings according to bound forms and short environments] are merely expressions of the relation between the particular environments in question, and the various morphemes which occur next to them, or the like. Relations of this kind are not to be disregarded, and are discussed in Chapter 17; but often they do not correlate with other relations, so that classifying morphemes on this basis would not necessarily lead to a simpler set of new elements."

The last remark is rather out of place, for no set of elements will be adequately accurate and simple if it

overlooks the important groupings according to inflections. A feature of the English language is that large numbers of morphemes will appear with one of a limited series of inflections, +o+n, in any sentence whatsoever (Methods 17.33).

Later, in Chapters 17 and 18, Harris recognizes the bound form distributions more fully, and brings them into the analytic system (p.356-7). But he maintains they have no necessary significance as markers of large morpheme groups, which are to receive separate status apart from the general classes theoretically established through Chapter 15. There may be a note of uneasiness (p.333, footnote 18), but the inflection classes are rejected for not only Chapter 15, but also for Chapter 16 where the sequence patterns are developed. (p.280, p.299, p.333 footnote 18, p.366).

As we have already remarked, it is interesting that the classes defined in M.U. and Methods do not easily exhibit procedures provided in Chapter 15. Indeed, they satisfy more closely an alternative type of analysis which is contrasted with accepted method in a footnote (Methods, p.299):

"Whereas Chapter 16 covered primarily what is called syntax, Chapters 17 and 18 parallel most of what is usually considered morphology proper. This

order of treatment was most convenient for the methods developed here. It is also possible, however, to treat the morphemic relations within whole-utterance environment (syntax) after the relations within smaller domains (morphology proper)."

If we were to disregard short environments and consider morphemes only in relation to longer free form patterns, we would have to disregard the possible use of ts on house as a marker of its class, and observe that it enters the frame The -- is here, just as large which can not take ts and cut which can also occur as td will do. Again, we would have to disregard the bound forms which mark out different classes in a frame like I walked --, and make in, home and here for example members of one class. As we have seen, this procedure is in fact not followed.

7.32 In brief, both long and short environments are needed for a statement of the occurrences of morphemes. This is because certain long environments can be found to determine the occurrence of one and only one class defined by a brief environment, while other long environments permit more than one brief environment class. n + s -
^t
t' n + o contrasts in this way with ^t
t' n + o v + s -, and can be considered diagnostic of y along with the verb inflections. The second frame may be considered diagnostic

of a general class which can be subdivided by studying the occurrences of its members in other places. It is quite certain, as Harris has pointed out in the quotation above, that long and short frames need not mark out the same groups of morphemes. Thus +s and +d can select two unique classes, while t - v + d can select the +o forms of both of these plus adjectives as well.

The method adopted by Harris is to select classes according to bound forms and other short environments and to let long ones become part of the formation rules.

7.33 Further reasons for the rejection of bound form analysis may now be dealt with.

"Furthermore, the syntactic analysis of Chapter 16 would in any case require the setting up of morpheme classes based on similarity of distribution in respect to the total utterance environments. In many cases such classes would cut across the various classes set up in respect to short environments, so that the work of classification would have to be repeated independently." (p.256)

It may be said that unless it is recognized somewhere that morphemes classified by total utterance environment, may be grouped differently by bound form environment, then any system will be inaccurate. A main point of previous discussion is that when zero

inflection forms occur in common environments, they are to be classified according to the examples of other inflections that enter there and which they use elsewhere. (3.12).

Harris is fully aware of this in many places, including sections of the chapter in which these quoted theories occur, but for some reason he tends to overlook it.

"We might plan to satisfy all considerations by classifying the morphemes on the basis of their short (usually immediate) environments, while using the utterance - long position as a criterion on the basis of which we would decide which immediate environment to regard as diagnostic. [This would be useful if the diagnostic position permitted no morphemes but those in a particular bound form class to enter]. But in many cases even this will not work out. For example, if we decided that the position before -ly was important in respect to utterance position, we would obtain a class containing not only large, clear, true, but also man (in manly). In terms of immediate environment, we would have no way of rejecting man, because the only straightforward way of separating the -ly of largely from the -ly of manly, goodly is based on the

position of these two in respect to the whole utterance," (p.256).

Such an argument scarcely carries any weight, because, for a full description of the occurrence of the morphemes man, good and so on, we need a full statement of their relations to free forms in sequence and of their relations to bound forms in sequence. One study of occurrence need not cancel out the other. If we study what precedes and what follows manly and largely they can be differentiated, while the fact remains that they both use the same bound form.

"Similarly the environment the - admits very, large, etc., as well as man, auto. And the environment the large admits and beautiful as well as man, auto; and many morphemes which we might wish, on utterance position grounds, to include in the class of man may not occur after large." (p.256).

Quite so. But if, for instance, we include large and very in the class of man, we need not and can not ignore that they occur separately in other longer environments, and that they belong to different inflection environment classes of major importance.

It is of interest that despite these comments Harris uses the - as a diagnostic frame for N. (M.U. p.167)

Whether it may be used alone and therefore allow A, or whether it should be used in conjunction with ts is not clear. Again, the - n is considered the diagnostic frame for A, although n + o and v + o may also appear here. (M.U. p.168). It is apparent that an even shorter environment, fly must be used to separate A from N.

7.3⁴ In summary, the preceding passages may be treated as an important instance of confusion which may be overcome by taking into account Harris' remarks concerning the necessity for recognizing sub-classes of general classes, bound forms and so on in both Methods (Chapters 15, 17 and 18) and M.U. This is true even though there are other passages where the results of the types of distributional study recommended are not fully understood by him. (See 7.4).

It is to be regretted that he did not thoroughly follow up for English classes his remark that

"We often find a number of morphemes or sub-classes each of which occur in a different utterance environment, but all of which occur always with some one other class. This is seen most generally in what are called noun case-endings, or tense and person conjugations for verbs." (Methods, p.306, Chapter 17).

7.4 Differentiation between Semantic and Syntactic Distribution.

7.41 Since we begin distribution studies on a corpus where the morphemes only are identified, we have to determine whether we are going to formalize all variations in their occurrence or not. For example, if we take a particular sentence I'll make the sandwiches with meat and compare it with I'll make the chair with cedar, we find that chair will not occur in exactly the same sequence as sandwich does. Variations like these may be dismissed as semantic in favour of other distributional features which we call syntactic because of the following reasons.

The analysis of the occurrence of morphemes may begin by examining their relationships with other individual morphemes in the sequential order of a single given sentence. Here we hold all morphemes in the sentence constant except one, and test out what other morphemes will fill the position of this one. We may then define a class of morphemes which will fill this particular frame, and say it has the frame as a constant feature. Thus The boy --s the dog will characterize a particular list called x.

We may then free the morpheme in the position preceding the blank, and see what occurs here in relation to the rest of the original sentence which now includes the morpheme previously omitted. Thus The -- likes the

dog. We may call the resulting class γ . It is then possible to try to free the position of ts and examine all the possibilities of morpheme occurrence here, again in relation to the original sentence. The process is repeated for each morpheme position until the last one is analysed. In some sentences it may be found that the position can not be freed for substitution because only the original morpheme will occur here. For example, to, in $m' v + s \quad to \quad v + o \quad t' \quad n + o$.

The next step is to re-examine each of the classes now created, and to see what other morphemes will substitute in a given position when any of the individual members of each class are selected and held constant in their positions to make a new sentence with the same sequential order. In this way we may keep enlarging the classes until all possibilities of occurrence in this particular sentence order are exhausted.

Thus if we take a simple arrangement of classes such as the following $/w \dots d/ \quad /x \dots g/ \quad /y \dots i/ \quad /z \dots l/$ and select $/w_a \quad /x_f \quad / - \quad /z_i \quad /$ as a frame, we may find that $y_{g \dots n}$ will occur. Then using each of the members of the classes in turn in continual re-examinations of each position, a point may be reached where no more substitutions will either be necessary (since we need only

examine commonly found words for some large classes) or will occur. We can now finally number the position of each class in sequence.

7.42 The classes then, are established only for this type of sentence and for no other, and their definitions are sentence long. But in some cases we can later discard the full sentence. For, as knowledge grows it can be found that a partial sentence is sufficient to determine that one and only one class will occur in a given position. (Cp. 3.13).

Examination of other sentences may show similarities of distribution or differences, and compact statements of morpheme occurrence may develop with re-definition, i.e. subdivision or enlargement, of already established classes.

It may be found that certain large classes of morphemes which appear with a small class consisting of just one or two other morphemes in a position of one particular sentence type, will also appear with a class of one or perhaps two other morphemes in another position in another particular sentence type, and so on. Similar results may appear for lists of words. The limited series with which the large lists occur may consist of bound forms of the kind known as inflections. So it can be useful to define the class of the large lists in

relation to a selected group of inflections as a whole, and to ignore conditions where only one member of the inflectional range will occur. Such conditions may then become part of subsequently developed formation rules used on the classes in order to create sentence patterns.

However, it is not necessary, though very probably more useful, to define a word class by an inflectional range. We could also make certain free forms fixedly diagnostic of a large class consisting of more than one syntactic class, and then put in rules to show where any individual member occurs. For example we could select the, v + o and to as free forms which are each capable of defining the word classes which immediately follow them. It may be that we can make an arbitrary choice whether it is more convenient to select bound or free forms to provide such compact statements.

7.43 A class constructed from other classes (or constants) though convenient, does not satisfy the definition of a syntactic class which can now be given. A syntactic class consists of single morpheme values which all occur where any one occurs in at least one given position of a sentence. No member or sub-group of a syntactic class ever occupies one or more exclusive sentence positions. Any morpheme or sub-group of morphemes which does is a syntactic element in its own

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right. (Cp. the definition of a logical constant p. 119).

It is obvious that each of the noun, verb and adjective inflections for example, has unique uses. So if an inflection range is accepted in this paper as a single class, it is necessary to realize that it is conveniently constructed out of syntactic units. Others of a different kind can be established. Again, it is to be noted that in accepting word classes, we allow sequences of morphemes of word length to obscure^{temporarily} the syntactic classes of the individual morphemes contained in them. (Eg. word formative~~s~~ like -able, -ize and so on. Compare 3.1).

The value of erecting the inflection classes (which include +o to denote when no inflection appears) is to have as a record that in all sentences certain lists of word length morphemes will always appear with one member of such a class. Other pieces of syntactic information could also be compactly arranged, and combined with formation rules in order to describe the language.

7.44 The outlined processes for extracting the syntactic elements from a text would be most easily handled by machines. They offer, of course, a re-statement of distributional procedures put forward by Harris. The main difference is that the possibilities of morpheme substitution are exhausted for each sentence

in turn, and that several sentences are not examined at once, as recommended in H.U. and Methods (Appendix to 15.4). The change provides some distinct advantages.

Firstly, it may be held that when we have exhausted the possibilities of occurrence for any one position in relation to the possibilities of occurrence for the other positions, we may say that the syntax of the sentence has been discovered, and may be expressed through a series of symbols which each represent the classes (which may have one member) in their order. A definition of syntax based on these views may be generally applicable to all languages.

When we test out what fills a position in relation to the class order, we are testing out the syntactic occurrence of morphemes. When we examine a position in relation to any member of one or more classes we are examining the semantic occurrence of morphemes. Thus t boy - t n + o enables us to define the distribution of morphemes in relation to the particular value, boy, in a particular kind of sentence.

We would also be able to hold that +s and +ed are in this sentence members of a class. But it is not necessary, and it is thought erroneous, to call them semantic members of the class. Both will appear elsewhere as logical constants. For example +n is irreplaceable in t n + s are v + ing t n + s v + n p t n + o and in

m^r v+d t n+s i HAVE v+n (The children are eating the apples stored in the shed; I payed the men who have worked). Although an adjective will appear in the same position as the value of v+n, it supplies a substitution for two morphemes and not one. The use of a+o to represent the absence of inflection is for purposes of recording convenience, and +o can not be counted as a morpheme position. This leaves in as a logical constant.

7.45 It can be taken as a definition that if a morpheme appears once as a logical constant, then it can always be treated as a syntactic unit, even though it may be replaceable in other sentence forms. Though we have seen that in this last case it can be treated as a value of a variable, it is a value of a special kind. A treatment which accepted it merely as a semantic unit, would overlook the fact that it supplies a meaning value which is indispensable in the over-all working of the language. In other words, it would ignore its particular nature as a grammatical category.

It may be that some positionally dispensable morphemes are so frequent that their semantic value becomes of great importance in the language. But this does not justify their confusion with genuine syntactic terms.

The definition is of use in those cases when

various inflections, or again, different word classes become mutually substitutable in certain frames. For example let us take The wounded require treatment and free +n for substitution. We find then that +s will occur. Then, if we free wound in relation to the two member class which results, we can get both nouns and verbs occurring in the same position - boy, girl, tire, fatigue and so on.

We do not wish to say the members of the second class thus set up have the same relation to either +n or +s, as values of other classes have to one another when no logical constants are involved. For example take the tall man, the bright light, the smooth path. Here we need to show that the differences of occurrence among the values of a+o in relation to those of n+o are of a purely semantic kind.

7.46 One of the values of the whole procedure is that it enables us to realize that semantic rules may vary from one field of knowledge to another, but that the syntax of the language will be valid for any one of them.

It could also deal with distributional features such as the splitting of nouns according to their he or she substitutions (p.303 Methods), and according to their combinations with prepositions. (Methods p.312 footnote 14), where it has not always been easy to decide whether

the subdivisions are syntactic or semantic.

The outline method has been developed here in order to make it clearer how to overcome the vast range of semantic combinations of morphemes in order to present syntactic rules. Harris is not particularly clear on this point. Thus,

".... x and y [morphemes] are included in the same element A [i.e. class] if the distribution of x relative to the other elements B, C etc., is in some sense the same as the distribution of y. Since this assumes that the other elements B, C etc., are recognized at the time when the definition of A is being determined, this operation can be carried out without some arbitrary point of departure only if it is carried out for all the elements simultaneously." (Methods p.7).

A clarification is required of what is meant by "in some sense", and by the establishment of all class elements simultaneously. It is hoped that this has been done, and that the procedure described may be compared with the discussion below on some methods recommended by Harris for establishing classes.^I

7.5 Errors in Procedures Recommended by Harris.

7.51 It may be argued that Harris has erred in both M.U. (3.2) and Methods (Appendix to 15.4) by examining the occurrences of morphemes in varieties of individual sentences, so that what constant features the classes may be defined by, need not be clear. It is true that the frame They will -- for instance, is picked out in the appendix as one which is common to all the words which fit in a selected variety of other positions, (although it will permit another word, it, to occur as well). But what the constant features of these other positions are in what types of sentences, remains obscure, and semantic restrictions appear to be included. Since one sentence is compared with another of different morpheme order, differences in total utterance environment may be lost when we compare specific features within them.

In M.U. (3.2 and footnotes) an example of how to begin analysis of morphemes into classes is presented. It is made clear that because house and poem can both appear in That's a beautiful -- they are to be put into one class. Even though poem will alone appear in I'm writing a whole poem this time, the class is to hold generally and not for the particular sentence containing beautiful, because house alone will appear in a comparable sentence, I'm wiring a whole house this time.

" morphemes having slightly different distributions are grouped together into one class if the distributional differences between their environments correspond to the distributional differences between the morphemes. That is, if poem and house differ distributionally only in the fact that poem occurs with write, and house with wire, and in comparable differences, we put poem in one class with house, and simultaneously put write in one class with wire." (M.U. p.164).

The essential question is how we know that write and wire may be called comparable environments for house and poem, without any further information. If a decision apparently as arbitrary as this is made, then we may also make a great variety of morphemes comparable.

Take: The boy likes the meal hot

The boy likes the public garden

Since meal and public will both occur in They do not like the --, it may be said that in the above examples the words provide the same environments for hot and garden. They may consequently be classed together (a) because of similarity of environment, and (b) because of their substitution for one another in at least one other environment such as The -- tap is here.

If we exclude the (b) condition, then other types of classification will also be permitted.

Take: I will fix the poem late tomorrow

I will fix the garden with wire

Since tomorrow and wire both occur in It should be --, and since poem and house will occur in That's a beautiful -- (that is, since both groups each have an environment in common) poem and house constitute one morpheme class environment, and tomorrow and wire another. Consequently late and with may be put into one class because they occur in between the same classes. That is, their distributional differences are correspondent, as it would be fairly simple to find "comparable differences".

It may be seen that all sorts of substitutions could be permitted, and a tremendous number of small classes could be set up due to the complexities of arrangement of individual morphemes in a particular corpus.

7.52 It is easy to understand, nevertheless, why Harris took this approach. He knew that certain morphemes will appear with members of certain limited classes (in these instances inflections, and so we must include +o as a usual bound form member) in any sentences whatsoever. Thus we may classify them together in relation to these inflections, and dismiss the remainders

of the sentences as definitive features. We may then consider other groups of morphemes in relation to these classes, to find out what else occurs with them, that is, what surrounding circumstances determine which of these classes will appear in a given frame. If more than one will occur, then it may be possible to set up a new class. Thus we could accept hot and garden as members of one class in certain kinds of sentences (or perhaps sequences, as they may be sufficient to determine occurrence) but not in others, while poem and house could be defined as members of one class for all sentences.

It is sometimes confusing that Harris has not given sufficient emphasis to the study of the regular occurrence of inflections and other bound forms when he describes the initial procedures to be followed in setting up classes. It is true that in Methods, Chapters 17 and 18, and sections of Chapters 15 and 20, as well as in sections of M.U., he is well aware of the importance of their recognition. But when describing how we are to start out analysing the occurrences of morphemes for establishing classes, (eg. Methods, Appendix to 15.4 and M.U. 3.2) he tends to suggest a kind of analysis which would produce results different from those he elsewhere accepts. (For instance despite the environments described here for write and wire, occurrence after N is not

listed as a marker of V in the definition of V in M.U.)

It is also confusing to find no differentiation between the semantic and syntactic occurrences of morphemes in Methods (p.243 foll.) so that approximation techniques are suggested. If the positional analysis outlined in 7.4 is followed, then approximation techniques in syntax are not required. Precise rules may be supplied for each sentence type.

7.53 Whether we gather together those features of occurrence for certain morphemes which are present in all or a specific number of sentences, and define the class by them, or whether we use separate symbols for any environmental occurrence of a morpheme class (eg. use p, and d, for the blank in sentences of the type Tom came --) is rather a matter of choice. The facts of occurrence however will remain the same. So long as the rules of ^{of English} distribution in each of the various sentences/with varying numbers of morpheme positions are in some way presented, we will actually find the same morpheme classes, no matter whether general classes with sub-classes, or a series of separate classes are used. The same applies to the element of choice in making a feature of distribution a defining characteristic of a class or a part of the formation rules. Again, whether we choose free or bound forms by which to define the classes is immaterial, though

one may be more convenient than the other. The type which is not chosen will be considered by some other means, and the same results will be gained.

The major point is to establish rules which state each acceptable positional use of various lists of morphemes. One positional pattern may be more important than another if it accounts for more morphemes in relation to it. Other sentence positions however may account for less morphemes, but be very important because they recur frequently. (Eg. consider some of the positional patterns which permit the use of Harris' class P).

In 3.1 the writer selected inflectional forms in order to define not morpheme classes but word classes. This was because the inflections are capable of characterizing large lists of words which each consistently appear in other positions with one of the members of the limited range of their inflectional or form class.

7.54 If the limits of an environmental frame used for defining classes are not made clear for each sentence of a given positional length, we may start with a type of analysis like the following where the morphemes appearing before over are collected together:

The plane came down/and/over

The child fell/slowly/over/

The plane was slow as it/came/over

We came home when the play/was/over

Can and, fly, came, was, all be listed as members of one class?

Such a question may appear foolish. But in a less obvious case, when we merely examine what occurs before as in any sentence, we might lump together nouns and verbs indiscriminately. So this example can serve to provide the answer that they can not, if we state an environment longer than over for them, and even more definitely not if we consider what substitutes for each of the morphemes when each sentence in which they occur is treated as a separate kind of substitution frame in relation to which they are defined.

Harris' views that short environments are of less value than long ones are probably based on considerations such as these, and it is to be noted that in the appendix to 15.4 (Methods) he defines the resulting class in relation to a full sentence, They will --. Here it may be remarked that his comparison of variously shaped morphemes in sentences of various lengths and in various orders, thus really becomes subsidiary to the selection of sentences in turn in order to examine them individually.

7.55 The fundamental fact is that there is no way of knowing distributionally that different individual morphemes in a variety of sentences provide the same class frame (i.e. syntax frame) as others, unless we first begin by exhausting their positional relationships to one another in individual sentences. (Compare the great variety of morphemes in a series of six positional sentences).

For example, it is only when this is done that we can classify morphemes by a feature which is common to all or a great number of sentences. When each kind of sentence is examined the knowledge can be gained that some morphemes always occur with one of a range of another kind either always, or under conditions which may be stated.

Unless we exhaust the substitution possibilities for each sentence before undertaking their comparison, we may be in danger of setting up semantic restrictions of occurrence which may not be either accurate or useful for a system, perhaps required in a machine, which needs a syntactic structure on the one hand, and freedom for the introduction of special semantic rules on the other. This is one of the main reasons for an insistence upon the distinction between syntax and semantics. Some semantic rules may not be valid in one system, while they are in another, but the syntax will be valid always.

Harris' diagram (Methods, p.353) could be altered to present the rules of morpheme occurrence in sentences as well as in words. It may be remarked that the positional numbering of elements used here for words, compares with that in "Axiomatic Syntax" by Harwood for sentences.²

7.6 Conclusion.

The type of analysis recommended for setting up morpheme classes in this paper may be compared with Harris' differentiation of morphemes in "From Phoneme to Morpheme"³, to the extent that each sentence is treated individually for substitution possibilities.

In another direction procedure may be used to see whether the methods recommended by him in "Discourse Analysis"⁴ may be altered in the light of a sound differentiation between semantic and syntactic content, so that features of personal style may be more adequately presented, and so that syntactic and semantic equivalences need not be confused.

Finally, it is hard for the writer to see that the types of analysis put forward by Harris in M.U. 3.2, and in Methods appendix to 15.4, can not allow semantic analyses of morpheme distribution which can compare closely with the results of procedures recommended in "Discourse

Analysis".² If we were to proceed with an analysis of what particular morphemes appear with what other particular morphemes, where no morpheme frame is held constant (as in classes 1 - 6 of the appendix) it appears that a kind of discourse analysis could result.

¹ It is also hoped that it will answer some points made by McQuown and Fowler in the articles of footnote 1, Chapter 8 below.

² Harwood, F.W., "Axiomatic Syntax", Language, 31 (1955), pages 409 - 413.

³ Harris, Zellig S., "From Phoneme to Morpheme", Language, 31 (1955), p.190 foll.

⁴ Harris, Zellig S., "Discourse Analysis", Language, 28 (1952), p.1 foll.

CHAPTER 8.

MEANING PROBLEMS.

8.0 Introduction.

Despite varied statements by Harris about meaning as related to distribution, it becomes evident that he aims to analyse both morpheme classes and class sequences on distributional material alone.

There has been some objection to this by recent writers¹ but it can be shown that the activity is valid and can be most useful in recording the signal rules of a language. When alternative analyses result for a language such as English, the same structural facts of order can still be recorded for ^{each} sentence form.

The activity recognizes its own limitations: that it does not deal with the meaning values of either classes or class sequences. If there is a desire to analyse the structure meanings of sequences, then a study of equivalences can link both distribution and meaning features. The chapter concludes with discussion of some current views in light of the previous sections.

8.1 The Place of Meaning in a Harris Analysis.

8.11 It is difficult to tell in "Methods" just to what extent sameness or difference of response, which is the only meaning characteristic permitted, is allowed to bear upon the inclusion or exclusion of morphemes in relation to a particular morpheme class, or later, upon the inclusion or exclusion of sequences of morpheme classes in relation to a particular word class.

A major question is whether different inflectional and non-inflectional classes like n, v and d can be classed together if they substitute for one another in certain sentences like

<u>Tom will be eating / cheese / by Mary</u>									
"	"	"	"	/	here	/	"	"	
<u>" " " " / cut / " "</u>									
(i.e. socially)									

If sameness and difference of response are to be considered, then, as in Fries' work, they can not be grouped into one unit.

Meaning of any sort is entirely excluded from discussion in M.U., so that previous criticism remains unaltered in regard to this article. We will consider some of the statements about the use of meaning in 'Methods'.

8.12 "In principle, meaning need be involved only to the extent of determining what is repetition. If we know that life and rife are not entirely repetitions of each other, we will then discover that they differ in distribution (and hence in 'meaning'). It may be presumed that any two morphemes A and B having different meanings also differ somewhere in distribution: there are some environments in which one occurs and the other does not. Hence the phonemes or sound-features which occur in A but not B differ in distribution at least to that extent from those which occur in B but not A." (Methods, p.7, fn.4). This principle is to be considered for all the elements, which include morpheme classes (at a different level).

However, the statement is rather confusing. It would lead us to suppose that not even knowledge of repetition is necessary, since different distributions alone may be investigated in order to establish differences of meaning. (And on p.8, footnote 7 proceeds without it).

The same kind of confusion may be seen in the following collection of remarks on how the morphemes of a language are established.

"Since meaning was not used as a criterion in setting up the morphemic segments, the segments resulting from 12.2 will not always be identical with those

which might be desired from the point of view of meaning analysis." (Methods, p.173). (These remarks may incidentally be corrected in light of the later article by Harris "From Phoneme to Morpheme"²).

This contrasts with:

"For the purposes of descriptive linguistics proper, when it is desirable to connect its utterances and elements with social situations, it suffices to define 'meaning' (more exactly 'difference in meaning') in such a way that utterances which differ in morphemic constituency will be considered as differing in meaning, and that this difference in meaning is assumed to indicate differences in the social situations in which these utterances occur." (Methods, pp.189-90).

And both remarks contrast with:

"... the morphemes are not distinguished directly on the basis of their meanings or meaning differences, but by the result of distributional operations upon the data of linguistics (this data including the meaning-like distinction between utterances which are not repetitions of each other." (Methods, p.363).

And again, compare a similar remark: for discovering phonological and morphological elements (at least), it is inescapable that besides data about sounds "we require data about the hearer's response". That is, we need to know whether one element elicits the same response as another or not. (Methods, p.20).

Reference is made to this principle throughout the section on establishing phonemes, and it is also considered for utterance - long elements such as tone or stress; yet as we have seen, it is elsewhere discarded in theories about setting up morphemes.

8.13 We now have a series of opposed points of view and desire a clarification of them, because the general method by which morphemes are established will bear upon an understanding of what method is to be used in setting up morpheme classes. A solution may perhaps be found in Harris' final survey, where it is made quite clear that for both the distinction of morphemes and of their classes, distribution only, with not even the use of repetition as a meaning characteristic, is the basis for analysis. There may be some difficulties, but distribution alone will be adequate (Methods, p.365, fn.6; p.372).

In particular, the chapter on morpheme classes in fact proceeds on a purely distributional basis. There are merely references to meaning which hold that a common meaning may be established for a class as an additional but not necessary characteristic. (Methods, p.252, fn.21; p.311, fn.21)

In summary then, we may contrast Harris with Fries, and permit what Fries calls differences of

structural meaning to occur within a class, so that prepositions, nouns and past participles (of the zero inflection kind) may be grouped together.

Since the chapter on morpheme sequences is also held to be purely distributional (Methods p.263, p.271) there will be no meaning limitation upon the systems developed later (Methods, Chapter 10) which are alternative to those put forward by Harris.

"AN = N does not indicate that the meaning of good boy is the same as that of boy, but only that when we find one of these we can substitute the other for it and still have an English utterance." (Methods, p.281, fn.43)

8.2 Comment.

8.21 There has been considerable discussion since Harris published 'Methods' on whether the refusal to use differentiation of meaning according to sameness or difference of response is useful. It is possible, as Harris himself has pointed out (Methods, p.173), that if we neglect meaning we may impose on a language one of a series of alternative analyses which does not agree with the meaning units people use. In that case, the system is as much an imposition as older semantic ones, in which for example a single hypothetical meaning unit has been imposed on several languages at once without truly reflecting their

structure. If one type of distributional analysis were imposed on varying languages so that individual differences of meaning and structure became patterned out, either to a small or a large extent, this kind of criticism could apply. (See M.U.7.8 for similar remarks).

An interesting idea, however, is that speakers of a language might also systematize in more than one way. Another and quite different point is that variations in distributional analysis may one day be reduced due to study of occurrences of sound signals (These could be important for example in examining the three sentences we have given on page 134).

Apart from such questions, the criticism that distributional analysis can overlook the way people use a language and the way it relates to their culture has been strong. But meaning analysis could possibly be of a similar nature. Only a very thorough examination could show whether Bertrand Russell in his analysis of English structure in "An Inquiry Into Meaning and Truth" uses meaning concepts which are fully correct.

It has been said of Kenneth L. Pike that he insists on handling language units in relation to human response, and not as a series of "arbitrary constructs" derived from distribution studies for electronic computers.³

8.22 It is true that some systems may result from distributional studies for which these general claims are valid. For example in the following chapter it can be seen that it is possible to set up sequence substitution units (longer than the word) of various kinds which may depend on purely arbitrary selection.

Despite this, other studies of distribution such as the examination of equivalences and implications as in 22.2, 22.4, and 22.5 may help us to eliminate arbitrary selection and establish those immediate constituents and structural meanings which English users accept. Meaning in sequence analysis is at this point considered for the first time, to the extent of studying the sameness or difference of referential content in sentence types whose class values are the same. But the procedure can not be attempted without distributional analysis. From the previous discussions on syntax, the view may be developed that actual facts about logical order may also be preserved when meaning analysis is quite disregarded.

As far as classes are concerned, that there are various ways of presenting the occurrences of morphemes may only tell us that the human mind is

capable of handling language material in more than one way, and does in fact do so. This amounts to saying that there can be more than one way of recording the same facts accurately discovered through distribution. The essential point is that morphemes are arranged in serial order, and that for the rules of a language system to be developed, their arrangements must be listed. If there is class meaning overlap in one position, then the structure is either ambiguous or else the uses of morphemes in other sentence patterns enable us to establish more than one class for this position. Thus n can be separated from a, n separated from y and from a, and so on.

Further, distributional studies need not cancel out meaning analysis. On the other hand they may be of great use. Formal conventions exist in order to carry meaning, otherwise there is no reason for their existence, and if the forms of a language are fully understood, then such vague structural meanings as some of those previously accepted may either be rejected as unrelated to the facts, or else given precise definition. Distributional differences do show differences in forms and can thus lead to differentiations of meaning. It is insisted that distributional analysis can handle language in relation to human response. We

may even add that the precise information it gives us may help in answering such a problem as the one whether languages express concepts of a universal kind or not.⁴

8.3 Two Current Opinions.

8.31 There are two more current views which require separate attention.

One is that even though distributional studies may provide rules which will generate the sentences of a language system, they are unnecessarily complicated, and that meaning studies through questioning an informant and so on will provide us with the same knowledge more easily. It is possible for this to be so, but as yet the method has not been successful in syntax. It could be that it is easier for an informant to tell us that +s has a number as well as a tense meaning, than to find out that there must be two different meanings from distributional studies. On the other hand there has been a great deal of effort made by grammarians and logicians to discover just what it is that certain syntactic units do mean.

Even if some direct or indirect means of extracting from speakers just what structural units they usually accept in a background automatic fashion, were to be developed, distributional studies would still be necessary, to analyse the forms of the units,

whether written or spoken. A study of a language is inadequate without knowledge of its signs, and distributional methods provide us with their serial order, a basic feature of any language communication.

8.32 The second current view concerns immediate constituent analysis. R. S. Wells, for example, maintains in "Immediate Constituents" that it can be carried out only up to a certain point without a consideration of meaning. (§.30)⁵

"Very simply, it is necessary because there are many instances of a sequence which in some occurrences has one meaning and in other occurrences has another, and which, moreover, has different analyses into IC's accordingly. An example is the sequence old men and women. In one meaning this is nearly synonymous with old men and old women; in another, with women and old men. One of the prime functions of analysis into IC's is to reveal a formal difference correlated with the semantic one. In the former meaning, the sequence is old/men and women, in the latter, old men/and/women." (§.30)⁵

Now such remarks may only serve to confuse the issues involved. It may be held as a primary

idea that the form of such sequences is itself ambiguous and that in any syntactic representation of them we must admit this to be true. Thus

$$\frac{a+o}{1} \quad \frac{n+s}{2} \quad c' \quad \frac{n+s}{2} = \frac{n+s}{2} \quad c' \quad \frac{a+o}{1} \quad \frac{n+s}{1}$$

or (exclusively) $\frac{a+o}{1} \quad \frac{n+s}{1} \quad c' \quad \frac{a+o}{2} \quad \frac{n+s}{2}$

No studies of the meanings in the original sequence will tell us which equivalence will hold. The meaning ambiguity is tied into the serial order of the words.

Any grammatical i.e. syntactic analysis of English will have to record the ambiguity as a feature. Consequently we reject Well's claim that "the grammarian must include among his data something more than morphemes and their sequences. Grammatical 'order' is something more than mere sequence." (§ 31).

The suggestion that there is something outside the form of the sentences that carries their formal meaning is incorrect. Actually, in the pages following this remark, Wells seems to mean that such ambiguous word orders may be matched to more than one formal sentence type, with their corresponding meanings. (Compare the use of equivalences later to determine IC's). As a result it may be said that it is impossible to ascribe one IC cut in preference to another, unless there is a particular environment, intonation pattern, or other formal characteristic, to denote one in preference to another. Because of this theory, Harris'

equivalences for solution of an ambiguity in Methods, p. 272, are rejected as semantic. The ambiguity should be recorded in the syntax.

8.4 Views on the Nature of Syntax.

A criticism may arise at this point that the writer is arguing about the mere matter of the definition of the terms "grammar" and "form", that if Wells' understanding of "grammar" were to be accepted, then the difference of opinion would not arise. This is not correct, for it is held that the form of a language can not be established without restricting "grammar" or "syntax" to the concept previously established, and that Wells' outlook tends to confuse a study of the values of variables (i.e. object language terms) with a study of metalanguage units. For instance some relationships of the values for each of the variables in a + o n + s c' n + s will eliminate ambiguity and some will not, as in hot drinks and ices. They have nothing whatever to do with the structure of the sequence and should not be taken out of the object language.

There are two ways of denoting morpheme meanings

- (a) through the sequential order of the signs,
- (b) through the signs as individual units. The first may be called formal and syntactic, the second

semantic; it is not useful to confuse one with the other. Formal conventions are observed in a language to carry meanings. If they are inadequate for some meanings, then we must admit this to be so, and point out that semantic values make the forms intelligible.

However, it may not be necessary to agree with Martin Joos that "As a usual thing, we can be sure, it is the semantic implausibility and little else that operates to block wrong readings."⁶

Future researchers will prove whether such a claim is correct or not, though the writer is of the view that at least for basic sentence types it is quite exaggerated (see ^{cas} 5.5 and 10.5). In any case, as Joos himself suggests, further knowledge of the formal features of spoken language may perhaps be introduced into such ambiguous written forms to enable a machine to develop unambiguous patterns for itself.

¹ (a) Haugen, Einar, "Directions in Modern Linguistics", Language, 27 (1951), p.219 (3.6) foll.

(b) McQuown, Norman A., a review of Methods, Language, 28 (1952), pages 500-1.

(c) Fowler, Murray, a review of Methods, Language, 28 (1952).

(d) Fries, Charles C., "Meaning and Linguistic Analysis", Language, 30 (1954), p.57 foll.

- ¹ (e) See also Hatcher, Anna G., "Syntax and the Sentence", Word, 12 (1956) p.236 foll. where such criticism is implicit.
- (f) Firth, J.R., "General Linguistics and Descriptive Grammar", Transactions of the Philological Society, 82 (1951). On page 82 he suggests that if meaning is excluded, then it follows that the ideas of Concepts and Mind are also excluded. I have never been able to see this and hope this paper shows otherwise.
- (g) Hoijer, Harry, Language in Culture, (Chicago, University of Chicago Press, 1954). The discussion "The Cultural Content of Language Materials" raises questions which relate to Harris' claims on the syntactic level.
- (h) Pike, K.L., Language in Relation to a Unified Theory of the Structure of Human Behaviour, Pt. 1, (Preliminary edition, Glendale, Cal.: Summer Institute of Linguistics 1954.) On page 22 he accuses American linguists of "concealing data" of a cultural kind by way of their scientific rigidity. Harris style syntactic method, however, need not conceal meaning data at all, but rather provide a starting point for its elucidation. If meaning is set aside to work on formal distribution, then this can be merely an attitude, not a fault so inherent in the system that it totally precludes meaning study.
- ² Harris, Zellig S., "From Phoneme to Morpheme", Language, 31 (1955), p.190 foll.
- ³ Hoijer, Harry, in a review of "Language in Relation to a Unified Theory of the Structure of Human Behaviour", Part II, (Chaps. 8-10) by Kenneth L. Pike (preliminary edition, Glendale, Cal., Summer Institute of Linguistics, 1955), Language, 32 (1956), p.477 foll.
- ⁴ For example, see Longacre, R.E., in a review of "Language and Reality" (New York, MacMillan, 1939, 2nd impression 1951) by W.M. Urban; and in a review of "Four Articles on Metalinguistics", (Washington, Foreign Service Institute, Dept. of State, 1949) by Benjamin Lee Whorf, Language, 32 (1956), p.298 foll.

- 5 Wells, Rulon S., "Immediate Constituents", Language, 23 (1947), p.81 foll.
- 6 Joos, Martin, in a review of "Machine Translation of Languages: Fourteen Essays", by Locke, William N. and Booth, A. Donald, (Cambridge, Mass., The Technology Press of the Massachusetts Institute of Technology; New York; John Wiley and Sons, 1955), Language, 32 (1956), P.293 foll.

CHAPTER 9.

MORPHEME SEQUENCES AS SUBSTITUTION UNITS.

9.0 Introduction.

Although Harris begins this section with the initial idea that sequences can be listed as substitutions of one another only if they have all the same environments, he shortly alters this view because of the few instances when a sequence will have the same total range of environments as another. He then holds that those individual cases in which substitution can take place are to be recorded. Nevertheless the original idea is not discarded in all work and leads to some error.

The modified theory of substitution classification allows alternative analyses of sequence relationships to be made in a given text. It will be seen that it can give rise to various I C cuttings, and that if a consistent system is to be developed on any occasion, then specification must be made of the cut to be adopted.

Existing distributional analysis alone need not produce results comparable to traditional ones, for there are a number of reasons why choice in I C cutting (i.e. specification of domain) is possible.

However, we will see that if a statement is required of how the users of the language structuralize sequences, then distributional study of features of spoken language, syntactic equivalence and sentence boundary, will limit the range of choice, and even perhaps make only one or two types of analysis possible.

However, the following discussion does not bear upon the absence or presence of alternative analyses among morpheme sequences, which merely make up individual words. Attention is centred upon units which consist of sequences^{of} at least word length. Consequently we use the term "word classes" instead of "morpheme class sequences" where required, and match sequences of word classes to them. Since the word classes clearly contain values of single morpheme length, we follow Harris in saying that a sequence may consist of a single morpheme. (Methods, p.263, fn.2)

9.1 The Procedures Claimed and Used by Harris.

The aim of the chapter on morpheme sequences in Methods is to "set up syntactic form classes which indicate what morpheme sequences have identical syntactic function, i.e. occur in identical environments in the utterance." (Methods, p.262)

"We equate any two sequences of classes if one of them is substitutable for the other in all

utterances in which either occurs." (Methods, p.263. For other quotations reinforcing this view see 10.4 following).

However a direct contradiction occurs in another series of remarks. For example: "Some sequences prove to be substitutable for a given morpheme class in particular environments and not in others." (Methods, p.265)

"In many cases substitution occurs only in the environment of some particular class or sequence. E.g. one member of A is replaceable by two, but only if a member of N follows: fine is replaceable by fine young in They are fine men, but not in They are fine. Instead of saying that $AA = A$ but only before N, we avoid the extra comment outside the equation by writing $AAN = AN$ (or simply $AN = N$, from which this can be derived). This equation provides only for the substitution which occurs, and leaves no basis for replacing A by AA elsewhere. The technique here is to include the limiting environment in the equation itself...." (Methods, p.265, fn.11. See also pp.283-5, p.296)

Raised numbers which have a similar effect are also commonly used, and so we may say that the first series of views receives a general and not just a specific contradiction.

9.2 Views About Alternative Analyses.

9.21 The theory and practice leaves open the opportunity for the development of many alternative modes of sequence substitution. But before giving them individual attention, we may examine Harris' reasons for the rejection of a particular alternative substitution in M.U. (He of course admits the possibility of alternative systems (Methods P.2, and M.U. p.181) but does not give word class sequences adequate attention.)

In M.U. he considers the problem of whether the system "may become too general to produce useful results" and rejects the substitution of (b) certainly for (a) know John in the frame I --- was in, largely because there is the possibility of a difference of intonation between the two resulting sentences. (a) can be given the intonation of two sentences while (b) can not. (M.U. p.166)

However, this same argument could apply to some of the substitutions he accepts. For example " $v_d^2 N^4 v^4$ (all under one sentence intonation) = $v_d^2 N^4 = v_e^2$ " (M.U. p.173)

A second reason for the rejection of the substitution is that an (a) and (b) equation "conceals the fact that certainly may also occur in another part of the sentence". (M.U. p.166)

If this possibility excludes equation, ²²⁹ then
 since a + ly moves very freely in all sentences, we may
 ask whether the substitutions which Harris has chosen
 to permit for a + ly move just as freely. If they do
 not, then they should also be excluded. For instance
 $DA^2 = A^2$ (M.U. p.172) should not be permitted because
 we may compare that's a / completely false / statement

That's a / false / statement

with That's a statement / completely false

That's a statement / false

The acceptance of $DA^2 = A^2$ does not satisfy
 the demand concerning certainly "that substitution of
 sequences be so carried out as to satisfy all manipula-
 tions of that environment which forms the frame of the
 substitution." (M.U. p.166) In any case this is a
 very vague standard of practice. What are the limits
 to the manipulation of an environment? If for example
 we change the intonation, then new possibilities of
 substitution are to be rejected because the environment
 is no longer the same as in the example above.

Further, there is the opposed point of view,
 pointed out here in 9.1, and also in the following:
 "If, however, it proves impossible to substitute the
 equivalents of a symbol for that symbol in some of its
 occurrences, we distinguish these occurrences by giving
 the symbol a distinctive raised number." (M.U.p.170)
 This permits us to link together certainly and know John

if they both fit one environment, no matter what happens in others.

It also permits us to reject as invalid Harris' final argument: The substitution of certainly "conceals the concord of was with John: for if we substituted we for I, we would still have was in We know John was here, but were in We certainly were here (M.U. p.166)

Elsewhere Harris does accept concord changes for singular and plural nouns, so that we may have I know (the men were in = the man was in) (M.U. 2.2, 2.3, 2.4)

Consequently the three arguments about intonation, manipulation of environment, and concord, so far provide no reason for excluding the substitution.

9.22 It may be asked just why is it that Harris wants to avoid it in favour of others. The real answer will be found to lie in his choice of basic formulas to which sentences are to be matched. (9.4)

Another answer may also eventually be found perhaps in his references to sound features such as intonation patterns and etc. They may be treated in this paper as constants, or else members of ~~such~~ small syntactic classes (if more than one pattern will occur with one sentence type) which are therefore significant differentially as formal signs. Although Harris might

ignore them in some of his formulas, he generally holds intonation stress and etc. in theory to be features which require observation. (Methods, p.281-2, M.U. p.179)

In this way we may try to link the sequence units that he selects with those that the users of the language accept, and say that his use of one type of analysis rather than another, draws upon his knowledge as an English speaker. However, it must be acknowledged that what influence features of spoken language have upon written symbols is not yet well analysed. Such an explanation in answer to why $n + o$ for example, and not $a + o$, is chosen as the class to which the sequence $\begin{smallmatrix} t \\ t' \end{smallmatrix} a + o n + o$ is matched in study of a sentence type such as $\begin{smallmatrix} t \\ t' \end{smallmatrix} a + o n + o v + d$, is not satisfactory.

It may be that spoken features will play an important part in reducing the possibilities of alternative analyses, and that along with other studies, such as recording of equivalences, they may help us to establish a unique system of I C's.

Whether this is true or not, it will be seen that if distributional analysis is applied only to the signs used in written texts (as tends to be the case in Methods) alternative analyses may be comparatively varied. Since it may also be useful for machine purposes to generate what occurs in written referential

statement without considering spoken language influence, it may now be useful to discuss alternative analyses a little further. Reasons for their occurrence will be taken in turn.

9.3 Alternatives due to the Nature of the Classes.

The word classes theoretically (and in some cases practically, as an examinations of the formulas in M.U. will show) do not enter environments exclusive to each class. Two or more word classes may all enter one or more free form environments, so that a sequence which occupies any one of these frames can be correlated with any one of the classes.

For example:

Harris' Notation.

(A) <u>I hit /quickly</u>	D (A + $!y \Rightarrow D$)
<u>I hit /the dog</u>	T N
<u>I hit /Tom</u>	N
<u>I hit /in anger</u>	P N
(B) <u>I am / warm</u>	A
<u>I am / here</u>	D
<u>I am /talking</u>	V - ing
<u>I am / by the window</u>	P T N
(C) <u>The president shut the window/as he came in.</u>	B I V P
<u>" " " " " /slowly</u>	D(A + $!y = D$)
<u>" " " " " /by the door</u>	P T N
<u>" " " " " /then</u>	B

The question of what word classes to choose as the ones to which the sequences are to be matched is not at present clarified by consideration of features of spoken language.

9.4. Alternatives Due to Choice in Basic Formulas used for Matching.

It is clear from the substitutions Harris uses, that when a word class sequence is reduced to the environmental status of a word class, the practice of matching to one class rather than another is due to the set of classes retained to provide the basic formula on which formation rules are to operate. Thus all sequences are matched to N and V, because N V is the one initial formula he accepts. Other classes could have been retained and a series of basic formulas used instead of one.

Harris can refuse to accept the cut in the ^(A)series for example, because his N V matching would demand a cut after I. This practice may be linked with our knowledge that all English sentences have to contain a noun and a verb or else be capable of containing them, except for a very few brief calls such as John! or answers such as Yes! Other word classes are dispensable. For this reason an N V analysis may be considered important.

Many alternative possibilities are indicated not because environmental distribution theory will not be satisfied, but because an N V matching has been chosen for all sentences. In other words, the selection of the one basic formula, N V, necessitates that the domain of a sequence permits an N and a V of a sentence to be retained separately as two classes. So for this reason alone the substitution of certainly for know John in M.U. (11.2) could be rejected.

The type of distributional analysis developed by Harris therefore depends on a decision in favour of an I C cut which is prior to any analysis. If we permitted more than one basic formula, if we chose a different I C cutting system, then our distributional analysis would follow this system and an N V cut would not be accepted. The members of the (A), (B) and (C) series could each be broken into three I C's and provide a number of different patterns. If the type of I C cutting to be adopted is not specified, then procedures when applied to a given text may provide inconsistent results, though making one type of analysis at one time and another at another, according as the classes present themselves.

It is even possible within an N V cut to provide an alternative analysis due to the possibilities of variation in sub-cuts. Consider the following:

The king || is / in the field

|| who was dethroned / is / outside Paris

|| fell

|| of England / is / here

The man || elected president / should take office / at once

|| fell (over)

|| walked into / town

Here, what are usually called the right expansions of a noun are included in the verb phrase. (In the second set note that the preposition is also included with the verb.) Intonation patterns may make such cuts invalid. But intonation does not bear upon the possible use of a three part cut instead of a two in the basic examples of the (A), (B) and (C) series.

The place of a footnote remark by Harris towards the end of Methods will now be obvious:

"an important factor in the compact statement of relation among elements is the specification of the domain over which the relation occurs. [This is the specification of the I C cut to be used] Within the domain, we state not only the occurring together or the substitution of elements but also their relative order, and any variation in these which depends upon the outer environment." (Methods, p.369, fn.11)

The specification of domain is of fundamental importance, and once prescribed can provide a coherent standard of practice. It should be made a prime consideration for any distributional analysis.

9.5 Alternatives When No Sentence Type Results from the Equation of Sequences to Classes in a Basic Formula.

In the preceding section the term "formula" and not "basic sentence type" has been used, because it is evident that N V stands for class patterns which do not occur. (See 10.3) Thus Cat miaows. (It is valid however when mass nouns and proper names are used). We would have to show that it represents The cat miaows, Cats miaow, and The cats miaow, before calling it a B S T (or a series of B S T's). (Harris has made an interesting attempt to do this.)

Whether the basic formula is a sentence type or not, the choice of analysis due to choice in specification of domain remains. But when the rule is not made that the classes to which sequences are reduced must always be capable of forming a sentence pattern, then many alternatives of substitution are opened up.

Take: The^{very}/big white house is situated high on the hill which is to the right of the town.

Beginning with The very big white house as the domain of very, we may equate the whole sequence to D.

But then we may treat it as the domain of white (A), or of The (T), or finally as Harris does, of house (H).

Similarly is situated high on the hill may be treated as the domain of on, or of any word of the sequence and equated at will.

The situation may become even more complicated. Since we may find the class D or the sequence A + ly instead of A in the same environment as high in is situated high on the hill, the whole sequence could be equated to a word class or sequence which does not occur in this particular instance. (The same sort of alternative is evident when Harris remarks that the frame the large "admits and beautiful as well as man and auto". (Methods, p.256)).

All the alternatives under discussion here, however, take place without any consideration of the effects of spoken language features on the written text.

9.6 Alternatives When Word Class Sequences Can be Equated to Other Word Class Sequences.

Since Harris permits morpheme sequences to be equated to sequences and not only to morpheme classes (Methods, p.263, p.264), it may be useful to consider the alternative kinds of I C cutting which result.

The man	who is	the president of the society
A		B
		<u>requires a sense of justice.</u>
The lawyer	likely to be	chairman stays.
A		B

<u>The boy</u>	<u>elected as</u>	<u>treasurer works hard.</u>
<u>The young woman</u>	<u>elected</u>	<u>leader needs a secretary.</u>
A		B

There are three ways of dividing these utterances where all sequences in each column are interchangeable: according to A, to B, or to both.

Without the consideration of the influence of spoken features, we can analyse texts not only in such a way as this, but also in ways like the following:

The children know / cats are animals.

Big brown / cats are animals.

Here: N V = A A inN V N

The dog saw / cats are in the garden.

Very small / cats are in the garden.

Here: N V = D A inN V P N

Consider also:

A X A + ly

The tall / man knocked / at the front door

Y X D A + ly

When / he came / inside / he asked to see mother

X A + ly (Z X A)

 Z X A

He wanted / to see if / the new house was / worth buying

X A + ly Y X

Mother slowly showed / him around / because / she was /

A

very reluctant to sell

X

My father / on the other hand / was eager

This sketchily shows that we can arbitrarily set up units which give us pattern types for many sentences. Thus A X A¹ly represents the pattern of the first sentence above. The analysis seems odd, but it is quite correct according to the substitution theory put forward by Harris, if we do not equate sequences to single word classes. ~~in the frame of the original sequence.~~

9.7 Final Remarks.

It may be seen that distributional analysis alone need not "yield many of the results traditionally sought in....syntax." (Methods, p.363). Harris' choice of an N V cut makes his own work traditional.

Again, since a number of alternative domains may be treated as units, a number of non-traditional structural meanings could be set up, so that not even meaning need necessarily enable us to decide what units are preferable. It is insisted that if one domain is held to be more correct than another, it should be because the forms of the language make it so. For example equivalences and spoken patterns may show what sequences to keep or not to keep as I C units with meaning significance.¹

¹ The relationship of this claim to relevant works mentioned in this paper is obvious. For instance, compare Seymour, C., "Immediate Constituents and Expansion Analysis", Word, 11 (1955), p.377.

CHAPTER 10.

THE SYMBOLIC SYSTEM USED BY HARRIS FOR REPRESENTING SUBSTITUTION POSSIBILITIES.

10.0 Introduction.

The desire by Harris to provide a precise system for stating the ways in which substitutions of morpheme sequences can develop one sentence out of another, has stirred active interest in his work. But the particulars of the type of calculus he sets up can receive some important criticisms.

Through a series of equations using raised numbers on morpheme class letters, he attempts to record the restrictions of the environments in which substitutions of sequences will hold. But the method becomes excessively complex, the symbols have clumsy interpretations and make it difficult to know exactly what substitutions are permitted and where. A greater variety of symbols could provide more intellectual ease in equational manipulation.

In addition, inaccuracies of substitution can be generated by the operation of the equations. These are so frequent that a general revision is required. If

the system is treated as providing basic sentence types on which formation rules are to operate, it will be seen that invalid sentence forms can be created. Again, if it is treated as a means of reducing larger sentences to basic forms, then invalid basic forms will also be created.

These weaknesses may be linked with the tendency to retain the idea pointed out in 9.1 that substitutions can be stated which hold in the total range of environments for the sequences involved. This overlooks the necessity to create a system in which the variation and complexity of substitutions in various environments of any given sequence can be expressed with ease.

A list of correct common sentence types which the system aims to generate has been included in an appendix, for purposes of comparison later with the common sentence types *Kirchénback* records.

10.1 The Introduction and Effects of Raised Numbers.

10.11. Since morpheme class sequences will substitute for one another under certain circumstances but not under others, it is necessary to examine how Harris records these limitations. He makes use of two methods in order to state the environment, or environments, in which an equation holds.

Firstly, such an equation as $AA=A$ (meaning that AA can occur where A occurs in all circumstances) is discarded in favour of $AAN = AN$, or better $AN = N$,

from which $AAN = AN$ can be derived by substituting AN for N . In this way, we are told that $AA = A$ only when it occurs before N . The environmental restriction is expressed in the equation itself. (Methods p.265, fn.11)

The sequence and the class, however, are still held to substitute for one another everywhere (Methods, pp.263-4, pp.265-6; M.U. p.170). For other equations this claim is rejected and further restrictions are introduced.

The second means of stating the environments in which an equation holds, does not add more classes or sequences to the original equation so that new and longer expressions develop, but uses a system of numbering the symbols.

10.12 It is necessary to quote at length the rules for their introduction and interpretation because they give rise to some discussion. Their effects are of a complicated kind and not always easy to understand immediately.

"We assign raised¹ to each class symbol, say N , when it first occurs in an equation. Next time the class N occurs, in a new equation, we check to see if the equivalents of N as stated in this new equation are substitutable for the previous N^1 . If they are substitutable, we mark the new N as N^1 ; if they are not we mark the new N as N^2 . This checking is carried out for the N of each new equation. Each time we test to see if the equivalent of the new N is substitutable for all preceding N^1 , or for all preceding N^2 . If it is substitutable only for the N^2 , we mark it as such. If in some equation (including the new equation itself, if it contains more than one N), the new N is not substitutable for either N^1 or N^2 , we mark it as N^3 ; and so on." (Methods, p.266)

This procedure has two effects. (1) Within any given equation. A class or a sequence in an environment can create a second sequence which substitutes for that class or sequence, but not in the second sequence itself. Thus $N^1 - s = N^2$ means that $N - s$ ~~can not~~ replace N in $N - s$. So also $T N^2 = N^3$ prevents $T T N$ from occurring. (Methods, p.266; M.U. p.170). (2) Both within and without the equation. It tells us when classes and sequences substitute for one another, and does not permit them to be mutually substitutable in all instances where one occurs, in contrast to the case of $A N = N$.

A class or a sequence or a series of these can substitute for one another, but only in certain environments of one or more of these expressions. Take $T N^2 = N^3$. This means first that N and $N - s$ substitute for one another only in the environment T -. The restriction occurs within the sequence of the equation, which is still free as a whole to enter ~~(all the enter all the enter)~~ all the environments indicated by N^3 .

Now, since no restriction is placed upon the environments which the new element N^3 may enter, it may be asked what it signifies in the equation. It means, (a), that given any of the environments where $T N$ or $T N - s$ occur, we may substitute one for the other, and also substitute $N - s$ or N for either. It also means, (b), that given an occurrence of N or $N - s$, no substitution of $T N$ or $T N - s$ can take place, unless the environment for N or $N - s$ is also one for both $T N$ and $T N - s$. Thus (a) and (b) both together state that N , $N - s$, $T N$

and $T N - s$, all substitute for one another in any of the environments of $T N$ and $T N - s$; but $T N$ and $T N - s$ can not occur in the environments where N or $N - s$ occur alone. Thus we have a rule applying to sequences not included in the equation itself.

10.13 This interpretation of the effects of the numbers results from the following:

"Each higher numbered symbol represents all lower numbered identical symbols but not vice versa. Therefore, the higher numbered symbols have a more inclusive representation, and are of greater importance in any compact classification of the morpheme sequences of a corpus." (Methods, p. 267).

"We therefore write $N^1-s = N^2$ and state that wherever N^2 occurs we can substitute for it any N^1 or another N^2 [(a) results] while for N^1 we can substitute any member of N^1 (never N^2). [(b) results]. (M.U. p.170).

"On the left hand side of the equations, each raised number will be understood to include all lower raised numbers (unless otherwise noted). Thus in $T N^2 = N^3$ we have not only the men (N^2) equalling N^3 but also the man (N^1). Any N^1 can be substituted for the N^2 on the left side." (M.U. p.170).

This last is a case of (b). Given the occurrence N^1 in an environment, N^2 can replace N^1 because it also occurs in this particular environment chosen for use in the equation.

10.14. It can be seen that the amount of information contained in the numbered symbols makes them unwieldy. For example N^3 stands for

- (1) The environments of $T N^2$, and $T N^1$.
- (2) The sequences N^1 , N^2 which enter the environment T .
- (3) The series of sequences (N^1 , N^2 , $T N^1$, $T N^2$) which are all permitted to substitute for one another in the environments of $T N^2$ and $T N^1$.

For N^4 , (1), (2) and (3) become more complicated. The effect which the introduction of a new number creates is not always immediately understandable. It is felt that symbols with a more limited range of meanings would be preferable.

10.15 We may now expand the (a) and (b) interpretations of equations using N with raised numbers for purposes of understanding and contrasting the section (10.2) to follow.

(a) We have seen that the occurrence of the sequences which define N^4 implies the occurrence (or substitution) of any of the sequences represented by N^3 , N^2 , and N^1 , in any of the environments of N^4 . The occurrence of the sequences which define N^3 implies the occurrence (or substitution) of any of the sequences represented by N^2 and N^1 in any of the environments of N^3 . And so on.

Therefore the general rule is that given N^4 , N^3 , N^2 , and N^1 as symbols standing only for the sequences that define them, and given any environmental occurrence of any one, each will always imply the occurrence of the lower numbered symbols. Thus $N^4 > N^3 > N^2 > N^1$.

N³ : T N-s

T N

The novels/you mentioned are on/the shelf

 $\Rightarrow N^2 :$

N-S

N-S

Novels/ " " " " / shelves

 $\mathfrak{N}^1 :$

N

N

Novel/ " " is "/ shelf

(b) We have just seen the substitution possibilities when longer sequences are reduced to shorter. It remains to find out what is substitutable when shorter ones are expanded. The previous quotations make it clear that given N^1 , N^2 , N^3 and N^4 as symbols standing only for the sequences which define them, the occurrence of any one in an environment where a higher numbered symbol can occur, implies the substitution not only of the higher numbered symbol, but also of any other lower numbered symbol.

Thus the occurrence of N^1 in an environment which is common to N^2 implies the substitution of N^2 . The occurrence of N^1 in an environment which is common to N^3 implies the substitution not only of N^3 , but N^2 as well. And so on. This is because N^3 on the right side represents all lower numbered symbols. (Methods, p.267). Thus N^1 in an environment of N^2 implies N^2 . N^1 in an environment of N^3 implies N^2 , N^3 ; N^1 in an environment of N^4 implies N^2 , N^3 , N^4 ; etc.

$N^3 V^4 P N^1$ (N^1 in an environment of N^4):

$N^3 \quad V^4 \quad P \quad N^1$
The teacher/rang/up/mother

$N^3 V^4 P N^2$: $N^3 \quad V^4 \quad P \quad N^2$
The teachers/rang/up/mothers

$N^3 V^4 P N^3$: $N^3 \quad V^4 \quad P \quad N^3$
The teacher/rang/up/the mothers
the mother

In (a) any of the environments of the higher numbered symbols allow the substitution of lower. This leaves the way open for inaccuracies (as we have seen). For example, the environments of the longest sequence which defines N^4 do not necessarily permit the occurrence of the series of sequences for which it stands. In (b), inaccuracies could possibly be generated, but it is likely that Harris has overcome them. Further treatment of inaccuracies will be given in 10.3.

The next section, however, will present viewpoints contrary to both (a) and (b).

10.2. Alternative Interpretations.

10.21 The main difficulty in accepting the previous interpretations arises because a comment occurs in M.U. which appears to contradict them, and because the meaning of the occasional use of two raised numbers on a letter is not fully clear. The comment is not included in Methods, and since Methods is the later publication we may perhaps finally dismiss it.

"On the right hand side...of the equations7 each number indicates itself alone: N^3 on the right can only substitute for another N^3 , and $N^{1,2}$ for an N^1 or an N^2 ." (M.U. p.170). This may be taken in association with the use of such formulas as $A^{1,2,3} = N^{1,2,3}$, (Methods, p.285) and $V^4 P N^4 = V^{3,4}$ (M.U. p.173) where the right hand expressions contrast with the use of only one number in other formulas. Are we to understand that when only one number is used on the right, lower numbers are not represented?

The comment certainly means that any of the environments of N^3 do not imply the occurrence of N^2 and N^1 . Only those environments of N^3 selected for use on the left hand sides of the equations will now permit the occurrence of lower raised numbers. Thus N^2 implies N^1 only in T -, and any other environment of N^2 which occurs on the left hand side of an equation. We have a view opposed to (a). Again, if N^3 does not represent N^2 and N^1 on the rightside, (b) must be modified. In this case, N^1 implies N^2 , etc., only in those selected environments which appear on the left sides of the equations.

As a result, all raised numbers are mutually substitutable in the environments which are used on the left hand sides. Outside of these environments, substitution is permitted only in the environments of those

sequences which define the right hand symbols with raised numbers.

Thus $N^3 P N^4 \approx N^3$ means that $N^1 \dots N^3 P N^1 \dots N^4$ all occur in the same environments as $T N^1$ and $T N^2$. N^1 and N^2 , however, do not do so. Again, $N^4 > N^3 > N^2 > N^1$ and $N^1 > N^2 > N^3 > N^4$ only in $N^3 P -$, $R - V^2$, $V^2_d -$, $V^1_g - N^3$, etc.; that is, only in sequences selected for use on the left hand sides of the equations. Elsewhere, (1) the environments of N^4 etc. do not imply the occurrence of any other class or sequence with a lower number. Elsewhere, (2) the environments of N^1 etc. do not imply the occurrence of any other class or sequence with a higher number.

10.22 It can be seen that since (2) alters (b) we may escape inaccuracies possibly permitted by allowing N^2 for example to occur when N^1 occurs in an environment of N^3 . However, the extent of inaccuracy (b) would cause depends upon the difference in occurrence of N^1 and N^2 in environments of N^3 . This may be little. Given N^1 in an environment of N^3 , N^2 might usually occur, and so on for the other symbols with raised numbers. The environments of higher numbered symbols which Harris selected for use on the left hand sides of the equations probably cover most of those cases where the lower numbered symbols also occur. But it will be seen that they also cover environments of the

higher symbols where lower numbered symbols do not occur. (10.3₄this paper)

This allows inaccuracies to be developed from rule (a) whether it is modified by (1) or not.

(1) could reduce the inaccuracies permitted by (a) since it allows higher numbered symbols to be replaced by lower only in certain given environments of the higher numbered symbols, and not in all. But if Harris has included most of the environments of the higher numbered symbols on the left hand sides, then whether we accept (a) or (a) modified by (1) does not matter a great deal.

10.23 There is a feature of the use of raised numbers, however, which makes 10.1 more acceptable. Since all English sentences are reduced to one formula "e.g. N^5 , V^4 , D and several contours" (Methods, P.274), all lower numbered N and V must be included in this formula. Thus N^1 to N^5 are mutually substitutable in the frame $\underline{-V^4}$. (D is optional in the formula). And V^1 to V^4 are mutually substitutable in the frame $\underline{N^5-}$.

Again, Harris' use of the equations (M.U. p.171 foll.) shows that the environments of the right hand symbols such as N^4 and N^3 , must be free to permit lower numbered symbols to occur. For instance, he takes $N^4 A^2 P N^4 = N^4$ and says that strawberries fresh from the field ($N^4 A^2 P N^4$) as well as hope (N^1) will occur in

It was only - that kept me going.

"The most inclusive elements, those to which the greatest number of different morpheme-class sequences can be equated are represented by the highest numbered symbols of each class. E.g. as between N^2 and N^3 the latter represents more sequences (all those of N^2 and others besides) and would therefore be taken here as the new morphological element, replacing the $N(=N^1)$." (Methods, p.273. See also M.U. p.165, 3.6)

10.3 Inaccuracies which Result from the Symbolic System.

With the acceptance of 10.1 the following list of inaccuracies will be seen to arise in four ways.

(1) When higher numbered symbols are replaced by lower in a left hand sequence of a given equation.

(2) When lower numbered symbols are replaced by higher in a left hand sequence of an equation.

(3) When a higher numbered symbol or a lower numbered symbol substitutes for the other in any environment of the higher numbered symbol. This practice results not only from (a) and (b) of 10.1, but also from the use of N^5V^4 (or similar) to represent all English sentences. The single formula probably covers most environments of the classes.

(4) In addition, when the raised numbers for a class are the same on both sides of an equation and one side is replaced by the other anywhere.

The examples do not claim to be exhaustive but will

serve to show that the system is sufficiently inaccurate to require change. They concern only those sequences of morphemes which are at least word length, except for examples (16) and (17). The equations used are those given by Harris (M.U. p.171, foll.) The first sentence of each numbered series is to be understood as the given utterance, and the sentences which follow those which result from the operation of the equations.

- (1) Man is a reasoning creature
Black man is a reasoning creature

$$A^2 N^1 = N^1 \quad (4)$$

- (2) The old man is president
" " " " new president

$$A^2 N^1 = N^1 \quad (4)$$

- (3) The old man is president
The old AAAn is president

$$A^2 N^1 = N^1 \quad (4)$$

- (4) That is a statement completely false
That is a statement false

$$D A^2 = A^2 \quad (4)$$

- (5) The men are here
Men are here
Man is here

$$T N^2 = N^3 \quad \text{(Note also that all the sentences reduce to } N^5 V^4 \text{ so that in the environment of } V^4, N^1 \text{ can occur)} \quad (3)$$

- (6) A major study is the novel
A major study is the novels

$$T N^2 = N^3 \quad (2)$$

- (7) He is a man
He is a men

$$T N^2 = N^3 \quad (2)$$

- (8) I put the books on the shelves close to the door.
I put the book on the shelves
I put books on shelves
I put book on shelf

$$N^3 P N^4 = N^3 \quad (1)$$

This formula also permits

$$\begin{array}{l} \text{I put books} \\ \text{I put book} \end{array} \quad (3)$$

- (9) the old men in the beautiful gardens
the old man in the beautiful garden
old men in beautiful gardens
old man in beautiful garden
the men in the gardens
the man in the garden
men in gardens
man in garden

These are all instances of $N^3 P N^4$ which equals N^3 . They may all consequently substitute for N^3 or N^4 in the sequences of

$$N^3 N^4 V_d^4 = N^3 N^4 V_e^4 P = N^4 \quad (1)$$

Thus: I will show you/the men/the children/like
 can be altered by replacing not only the men (N^3) and the children (N^3), but also you (N^4), by any instances of sequences with the same form as above. (1)(3)

We can then write:

I will show/old woman at new home/old man in
beautiful garden/children of slum/like

An instance of $N^3 N^4 V_e^4 P$ can also be treated in the same way. Thus I will show you the house he slept in will change into similar inva~~l~~ted forms.

- (10) I will show you men children like
I will show you men N.Nn children like

$$N^2 N^2 = N^{1,2}$$

This equation permits the repetition of N^1 or N^2 in an $N^2 N^2$ sequence without limit. Compare the example in series (3) (4)

- (11) I will lend you the clock he fixed
I will lend you clock man fixed

$$N^3 N^4 V_d^4 = N^4 \quad (1)$$

I will lend you clock fixed

$$N^2 N^2 = N^{1,2} \quad (1)$$

(The remarks in M.U. rejecting possibilities such as the last are invalid, because raised numbers on the left permit all lower numbers at will.)

- (12) I think we will make Harding President when we vote tomorrow.

I think we will make President when we vote tomorrow.

$$V_f^2 N^4 N^4 = V_e^2; N^2 N^2 = N^2 \text{ can operate within the first sequence.} \quad (1)$$

- (13) We ate cheese
We ate countries cheese

$$N^2 N^2 = N^{1,2} \quad (1)$$

- (14) We'll make him vote
We'll make elector vote

$$V_g^1 N^4 V^3 = V^3 \quad (1)$$

- (15)

<u>Did you see</u>	the car red with the paint	he	used up
<u>Did you see</u>	N^4	N^4	<u>used up</u>
<u>Did you see</u>	$V^3 - \text{ing}$	$V^3 - \text{ing}$	<u>used up</u>

$$V^3 - \text{ing} = N^4$$

($V^3 - \text{ing}$ could also be placed invalidly in previous cases of N^4) (3)

- (21) The disillusioned artist has stopped working.
The (V⁴, any expression) artist has stopped working

No differentiation is made between the finite verb sequence and the "past participle".

(See M.U. p179, 7-3).

(3)

- (16) I eat it
I have eaten it
I am have eaten-ing it
I have been have eaten-ing it

$N^5 V^4$ symbolizes I eat it (3)

$V^1 > V^2$ in any position of V^4 (3)

(a) have V^1 - en = V^2

(b) $V^1 V^2$ - ing = have V^1 - en V^2 - ing = V^2

When the V^2 of each of the (b) sequences are replaced by the defining sequence for V^2 in (a) the invalid forms above result.

- (17) The use of - ing after V^2 allows many inaccuracies because V^2 is defined by sequences which do not combine with - ing.

Thus $R V^1 = R = V^2$

(will go = will)

and $V^2 N^4 N^4 = V^2$ (make Harding President = V^2)

- (18) We will bake the cake
We will the cake

$R V^1 = R = V^2$ (4)

- (19) We tried to escape
We tried to have escaped

have V^1 - en = V^2 and can therefore be used
 in V^3 to $V^3 = V^3$ (1)

$V^2 N^4 V^4$

- (20) I / know/ he / is / now
I / know/ he / is / slowly now

(a) $V^4 D_a = V^3, ^4$. This operates in the first sequence of

(b) $V^2_d N^4 V^4 = V^2_d N^4 = V^2_e$. And

(c) $V^4 D_a$ implies $V^2_e D_a$ (1)

Although it is said in both Methods (p.268, fn.19) and M.U. (p.178, p.180) that the equations are sketchy and need refinement because they will generate what does not occur, it appears that they are at present not accurate enough to be of any great use. It may be that with examination of the more complex sentences of written texts the system will be shown to be of even less value. Just one of the problems is how to prevent repetitions as in series (3) and series (10) without making the symbols and numbers highly complex and clumsy to interpret. It appears that a greater variety of symbols for various purposes would be easier to control.

Besides generating sequences that do not occur, the formulas also do not generate some that we would expect to find. (This is noted in M.U. p.166, 3.8).

The omissions noted in 10.5 are common enough to warrant inclusion. However we could expect more complications with possibilities of inaccuracy if they were gathered into N, V or D expressions. For example, to V must be prevented from occurring in some positions of N.

10.4. Conclusion.

The opinion may be taken that Harris developed these errors because of a tendency to overlook the

variations in environment which members of a list of sequences (including morpheme classes) can exhibit, even though they might have one or more environments in common. While he does recognize the necessity to show the particular environments in which sequences will occur, on the other hand, for example, he assesses the results of the use of raised numbers in a misleading fashion.

"We now have new morphological elements, each a class of sequences of morpheme classes (including single classes) which can substitute for each other in any environment whatsoever." (Methods, p.273)

"R.S.Wells terms N (up to its highest raised number) the expansion of N^1 , i.e the expansion of a morpheme class is the class of all sequences which occur in its environments." (Methods p.273, fn 28).

These and other comments noted in 9.1 fail to realize the extent to which substitution possibilities of sequences will vary according to the environments of the individual class to which they are equated. In other words, in supposing that we can get a class of sequences which fit all or nearly all environments of a single morpheme class such as N, Harris overlooks the degree to which the possibilities of substitution vary according as N enters one environment or the other.

As a result, when the system is treated as a means of providing an initial set of sentences upon which formation rules can operate to generate the structure of the language, we see that it is inaccurate. A sentence like n+o v+s can generate sequences which do not occur. Again, when the system is treated as a means of reducing longer and more complex sentence forms to shorter ones, we get similar results. It is not correct to say that:

"The work of analysis leads right up to statements which enable anyone to synthesize or predict utterances in the language. These statements form a deductive system with axiomatically defined initial elements and with theorems concerning the relations among them. The final theorems would indicate the structure of the utterances of the language in terms of the preceding parts of the system. (Methods pp. 372-3).

However, although there is considerable error in detail, and although a different mode of notation may be more useful, the system has invigorated studies with a sound general method of approach.

10.5 Appendix: The Basic Sentence Types.

The common English sentence forms recognized by Harris follow. Since he reduces all sentences to $N V X$ (where X represents the class of utterance contours; see Methods p. 349) we may take $N^4 V^4$ (M.U. p. 175) as the single formula required to represent all the sequences

single formula required to represent all the sequences which make up commonly found English sentences. (Cf. Methods, p.274) Using the rules of substitution, i.e. the formation rules, which the formula covers, we may begin with a case of NV and expand it so that a sketch of the correct sentence patterns which Harris recognizes is presented for comparison later with those recognized by Reichenbach and Fries. The sketch results from H.U., and although it does not claim to be absolutely complete it is nearly so.

We begin with $\bar{n} + o \quad v + \overset{d}{s}$ and $n^{sg} + o \quad v + \overset{d}{s}$, but this has no special significance. It is clear that Harris must consider $n + s$ and $t \overset{n+o}{n+s}$ followed by $v + \overset{s}{d}$ as more common and therefore more important. The use of \bar{n} will be dropped early.

N expansions.

$$(1) \quad \overset{n^{sg}}{\bar{n}} + o \quad / \quad v + \overset{d}{s}$$

John	came
Cheese	ripens

$$(2) \quad n + s \quad / \quad v + \overset{d}{o}$$

Birds	fly
-------	-----

$$(3) \quad \overset{m^3}{t} \overset{n+s}{\bar{n}} + o \quad / \quad v + \overset{d}{o} \overset{s}{s}$$

His	child	plays
These	boys	jump

$$(4) \quad t^* \overset{t^*}{m^3} \overset{n+s}{n} + o \quad / \quad v + \overset{d}{o} \overset{s}{s}$$

All	our	trees	bloom
-----	-----	-------	-------

(* Indicates special selection)

$$(5) \quad a + o \quad n^{sg} + s \quad v + \overset{d}{s}$$

Brown coal ignites
Brilliant plays re-open

$$(6) \quad \overset{m}{t}^3 \quad a + o \quad n + \overset{s}{s} / v + \overset{d}{s}$$

This brilliant play re-opens

$$(7) \quad \overset{m}{t}^3 \quad \overset{d}{a} + ly \quad a + o \quad n + \overset{s}{s} / v + \overset{d}{s}$$

A completely different approach helps

$$(8) \quad \overset{m}{t}^3 \quad a + o \quad \overset{d}{a} + ly \quad a + o \quad n + \overset{s}{s} / v + \overset{d}{s}$$

Such ridiculous wholly unacceptable ideas fail.

$$(9) \quad \overset{m}{t}^3 \quad \overset{d}{a} + ly \quad a + ly \quad a + o \quad a + o \quad n + \overset{s}{s} / v + \overset{d}{s}$$

A very rigidly conservative young man spoke

$$(10) \quad \overset{m}{t}^3 \quad n + \overset{s}{s}' \quad n + \overset{s}{s} / v + \overset{d}{s}$$

Some doctors' bills remain

(Both $n + \overset{s}{s}'$ and $n + \overset{s}{s}$ can be expanded the same as $n + \overset{s}{s}$ is expanded in previous formulas)

$$(11) \quad \overset{m}{t}^3 \quad n_1 + o \quad n_2 + o \quad \dots n_n + o \quad n + \overset{o}{s} / v + \overset{d}{s}$$

Our garden hospital scheme succeeded

(all n expandable as in previous formulas but with new restrictions required)

$$(12) \quad \overset{m}{t}^3 \quad \overset{v}{a} + \overset{r}{o} \overset{w}{y} / v + \overset{d}{s}$$

The red gleams
The young die

- (13) $\begin{matrix} m^3 \\ t \end{matrix} \begin{matrix} d \\ a \end{matrix} + ly \quad a + o \quad / \quad v + \begin{matrix} d \\ s \end{matrix}$
The very old return

- (14) $(t) \quad n_1 + \begin{matrix} s \\ o \end{matrix} \quad of \quad n_2 + \begin{matrix} s \\ o \end{matrix} \quad / \quad v + \begin{matrix} d \\ s \end{matrix}$
(The) Smoke from coal smells
Friends of animals spoke

(Both \underline{n} replaceable by previous N formulas and \underline{n}_2 replaceable by following ones. Note that Harris marks this sequence N^3PN^4 , M.U. p.172)

- (15) $(t) \begin{matrix} n \\ t \end{matrix} \begin{matrix} sg+o \\ n+o \end{matrix} \quad of \quad p \quad n + \begin{matrix} s \\ o \end{matrix} \quad of \quad p \quad n + \begin{matrix} s \\ o \end{matrix} \quad / \quad v + \begin{matrix} d \\ s \end{matrix}$
Work by men of strength endures.

(All \underline{n} replaceable by previous N formulas but whether by any following is uncertain. See M.U. p.172)

- (16) $(t) \begin{matrix} n \\ t \end{matrix} \begin{matrix} sg+o \\ n_1+o \end{matrix} \quad n_2^{m'} + o \quad v_d + \begin{matrix} d \\ s \end{matrix} \quad / \quad v + \begin{matrix} d \\ s \end{matrix}$
The man he selected leaves

- (17) $(t) \begin{matrix} n \\ t \end{matrix} \begin{matrix} sg+o \\ n_1+o \end{matrix} \quad n_2^{m'} + o \quad v_e + \begin{matrix} d \\ s \end{matrix} \quad p \quad / \quad v + \begin{matrix} d \\ s \end{matrix}$
The shop he works in closed

(In (16) and (17) \underline{n}_1 is replaceable by all previous N formulas and \underline{n}_2 by those and following. M.U. 4.35 marks the formula $N^3 N^4$etc. But new restrictions are needed)

- (18) $(t) \begin{matrix} n \\ t \end{matrix} \begin{matrix} sg+o \\ n+o \end{matrix} \quad a + o \quad p \quad (t) \begin{matrix} n \\ t \end{matrix} \begin{matrix} sg+o \\ n+o \end{matrix} \quad / \quad v + \begin{matrix} d \\ s \end{matrix}$
Faces rosy from the fire appeared

- (19) $t \quad a + o \quad n + \begin{matrix} est \\ s \end{matrix} \quad a + o \quad / \quad v + \begin{matrix} d \\ s \end{matrix}$
The fastest rate permissible alters

(The replacement of n is limited by Harris to those formulas marked N²).

The forms of the N IC (called N⁴ by Harris) are now completed with the additional information that each whole one can be replaced by Harris' class I, called m¹, m², m⁴, t¹ and the constant it by us.

(See I, M.U. p.168 & p.174), and by certain verb forms listed by Harris under the head of V³ - ing. (See M.U. p.174. V³ - ing = N⁴.

V³ - ing includes v + ing, n + ^so, v + ing p, _b v + ing N⁴ V⁴,

_b v + ing N⁴ to V³, and etc., but not all forms of it are acceptable.

For a full statement of what it covers see all equations involving V¹, V² and V³ in M.U.)

N replacements are not confined to the environment of V above, but may occur also where a member of the N IC occurs below.

V Expansions.

The n formulas will now merely be given the heading of N, and will all occur in any formula below. (not) and (^dsa + ly) are dropped before y after (26) but may equally occur in following formulas.

Statements.

(20) N / ^dsa + ly v + ^dso

We closely watch

- (21) N / ^{Will}HAVE (not) (^da + ly) v + o $\sqrt{v + d}$ when HAVE is used⁷
DO

We did(not) (carefully) watch

- (22) N / HAVE (not) v + n

The children have eaten

- (23) N / (^da + ly) ^{BE}v_c + ^do (not) v + ing

The children ^{are}stop eating

(For the introduction of ^da + ly here, see M.U. p.171.
D V¹ = V¹ limits it to occurrence before the full
finite verb).

- (24) N / HAVE (not) (^da + ly) ^{BE}v_c + n (not) v + ing

The children have ^{stopped}been eating

(The introduction of not is presumably correct. See M.U. p.173

R_a not = R_a)

- (25) N / (^da + ly) ^{BE}v_b + ^do v + n
a + o

The milk stays fresh

The milk comes pasteurized.

- (26) N / ^{Will}(not) (^da + ly) v + o

The family will go

- (27) N / v + ^do P_b (P_b)

The men came in (on) (up)

(v + o^d replaceable by preceding V formulas and by the following up to and including (31).)

(28) N / v_d + o^d N
We take it
 (v_d + o^d) replaceable by all preceding V sequences using v_d)

(29) N / v_d + o^d p (ltd) N
I work in the office
 (v_d + o^d replaceable by preceding v_d sequences)

(30) N / v_d + o^d N p (ltd)
I work it in
 (v_d + o^d replaceable by preceding v_d sequences.
p (ltd) does not necessarily have the same membership as in (29)).

(31) HAVE
 MAKE
 N / v_f + o^d N N
The people make men heroes
 (v_f + o^d and MAKE and HAVE are replaceable by only a few preceding V formulas)

MAKE
 HAVE
 (32) N / v_g + o^d N v + o

The voters make him retire

(v_g + o and MAKE and HAVE are not replaceable by any preceding formulas except (20) and (21) because Harris marks v_g up v_g¹. This means (21) is cut out invalidly because it is v_g². v + o is replaceable by all preceding V formulas, but not all are invalid) It can also be replaced by formula (32) itself and by (33) as well as by (34) when it is v_e. See V² M.U. p.173).

$$\begin{array}{c} \text{HAVE} \\ \text{MAKE} \end{array} \begin{array}{c} d \\ s \\ o \end{array} \quad N \quad \begin{array}{c} (\text{HAVE} \\ (\text{MAKE} \end{array} \quad \begin{array}{c} d \\ s \\ o \end{array} \quad N \quad v + o)$$

The old men make the young men make him vote (32)

Consider also: The old men make the young men give the boy
a shilling (34)

$$(33) \quad N \quad / \quad \begin{array}{c} BE \\ d \\ s \\ o \end{array} \quad N \quad to \quad v + o$$

The voters force him to retire

(v_b (plus BE) is replaceable by all \underline{v}_b (plus BE) formulas up to (31).

$v+o$ is replaceable by all V formulas up to (31) plus

(32), (33) and (34) when it is \underline{v}_e , with suitable

inflection restrictions. Note that although force is

the \underline{v} used by Harris, it does not seem to satisfy \underline{v}_b as

defined M.U.4.1. $N / v_e + \begin{array}{c} d \\ s \\ o \end{array} \quad N \quad to \quad (v_e + o \quad N \quad to \quad v + o)$.

The old men force the young men to cause him to leave).

$$(34) \quad N \quad / \quad v_d + \begin{array}{c} d \\ s \\ o \end{array} \quad N_1 \quad P_c \quad N_2$$

We gave the dress to the girl
We made a dress for the girl

$$N \quad / \quad v_d + \begin{array}{c} d \\ s \\ o \end{array} \quad N_2 \quad N_1$$

We gave the girl a dress
We made the girl a dress

(\underline{v}_d is replaceable by all preceding \underline{v}_d formulas, i.e. all except (25) and (31-33). It seems that \underline{v}_d in these sentence types should be defined as a special class).

$$(35) \quad N \quad / \quad v_d + \begin{array}{c} d \\ s \\ o \end{array} \quad N \quad v + \begin{array}{c} d \\ s \\ o \end{array}$$

We know she came

((a) The same rules of substitution for \underline{v}_d as in (34) apply.

(b) $v + \begin{array}{c} d \\ s \\ o \end{array}$ replaceable by every other V formula.

(c) $N \quad \underline{v} + \begin{array}{c} d \\ s \\ o \end{array}$ replaceable by $N \quad (M \quad U \quad p.173, \quad v_d^2 \text{ and } v^4 = v_d^2 \quad N^4)$

- (d) The whole sequence can replace v_e in formulas up to and including (27). These are few).

(36) $N / v + \overset{d}{o}$ to $v + o$
We tried to escape

((a) $v + \overset{d}{o}$ and $v + o$ replaceable by all preceding V formulas, and by this one (36).

Thus: We tried to kill the guard to avoid getting caught. (Harris W U p.175)

...to $v + o$ t $n + o$ to $v + o$ v + ing v + n

(b) The whole sequence can replace $v + o$ in (32) and (33).)

(37) $N / v \overset{d^s}{a} + ly$
The buses run slowly
 (V stands for all V formulas)

(38) $N / V p N$
They gave the boy a shilling in town
The work is in town
 ($p N$ is different from p^N in (29).)

Questions.

(39) r
 DO
 will (not) N (not) $(\overset{d^s}{a} + ly) v + o (\overset{d^s}{a} + ly) ?$
 ($v + o$ replaceable by all V formulas from (20) to (31). Not all are accurate)
Will the boxes fit?

- (40) HAVE (not) N (not) v + ing ($\overset{d^s}{a} + ly$) ?
BE

Are many children coming?

Have many children come?

HAVE

BE

- (41) will (not) N?

Were you with him?

Has she?

(See definition of R_a , M.U. pp.167-8)

- (42) N v + $\overset{d}{o}$ ($\overset{d^s}{a} + ly$) ?

The milk has been pasteurized?

(Only V formulas from (20) to (31) inclusive are permitted to replace $v + \overset{d}{o}$. See M.U p.171

$R \ N^4 \ V^2 ? = N^4 \ V^1 - en ? = bc \ N^4 \ V^1 - en ? \dots = N^4 \ V^2 ?$

The other V are not noted in this utterance contour anywhere)

Formulas other than those of N or V, involving full sentence ~~from~~ as environment: in (44) to (49) inclusive Harris allows the formulas to appear after Z, but not in (43). Not all of these changes would be correct. Eg (47)

- (43) $a + \overset{6}{o} \ \bar{z}$
n + $\overset{6}{o}$ as N V / Z

Dangerous as it is, we must go.

(All N will appear where $\overset{a}{n} + \overset{6}{o}$ appears

- (44) c N V / Z

If he returns I will leave

(45) p n + ^s N V / Z

In the work she does he sees the influence of
her mother.

(n + ^s is replaceable by all N formulas from (1)
to (15) inclusive.)

BE
MAKE
DO

(46) N v + ing v + n / Z

The men being isolated we made camp quickly

(v + ing replaceable by V formulas with +ing
suitably introduced. See M.U. p.174. $BN^4 V^4 = \dots$
 $= N^4 V^3 - ing = V^3 - ing = P N^4$)

(47) v + ing / Z

Entering we found another door

(v + ing replaceable by V formulas with +ing
suitably introduced)

(48) N V c N V
V

We went but returned quickly
We went but we did not stay

(49) p N)
a + ly)
d^s) Z
N³(ie N))

formulas from
(1) to (14)

In a moment)
Slowly)
Here)
Some day)

he will come

(See H.U. p.174. Harris restricts the n of p N. It seems that a class like nth is required)

The skotch is now completed with only one remaining comment. Harris notes that x (i.e. any class) can be replaced by x c' x in any formula.

Some omissions become apparent. The following sentences will illustrate:-

- (a) Question forms are not sufficiently varied. They ignore the use of i (included in I by Harris in H.U. 4.3) in common patterns such as
- Which house did you like?
- (b) to v + o and expressions of it are not included in N. To infer that men are equal is to err.
- (c) e v + ing (with expansion of v + ing) is not included in higher numbered symbols. (Though p v - ing = p N (H.U. p.174).)

She fell over while running

- (d) t N $\frac{v}{a} \frac{n}{o}$ is not included in N. (a + o in (19) is $v^1 - v_n$ (H.U. p.174) and so a special case.)

We will make make the invitations small

- (e) The comparative expressions have no representation.

The wardrobe is as high as the picture rail
It is not less than ten miles to the store
John is taller than Mary

- (f) that, which, who, are not introduced immediately after n, as for example in

The children who came Z

- (g) Does not is not introduced as an expansion of an affirmative. The formulas with R_a (H.U. p.173) permit not to be introduced only when does already occurs.

The milk stays fresh

The milk doesn't stay fresh

- (h) $\frac{ds}{a} + ly$ can not occur between the words of the finite

verb-phrase such as $\frac{BE}{HAVE} v + n$, $\frac{BE}{HAVE} v + n v + ing$,

$\frac{v_c + \frac{d}{s}}{BE} v + ing$, etc.

We have already stopped eating.

The children are quickly eating.

PART III.HANS REICHENBACH ON
LOGIC AND ENGLISH.CHAPTER 11.INTRODUCTION

11.01 Since the relationship between logic and natural language has given rise to discussion amongst both logicians and linguists, it is the aim of this section to elucidate more exactly what bearing they have upon each other¹. The calculus of functions has been applied directly to the analysis of conversational language by Hans Reichenbach in "Elements of Symbolic Logic"². This will supply material for study.

He works from the point of view that logic, as "analysis of language" in which "logical laws" are the "rules of language", makes deductive processes clearer and easier because it simplifies language structure.

".... the symbolism eliminates the specific meanings of words and expresses the general structure which controls those words, allotting to them their places within comprehensive relations."

(E. pp.2-3, cp. also E. p.255)

However, it will be found that these claims are certainly not satisfied when the functional calculus is applied to English. In fact, a great deal of criticism of Reichenbach arises. But while this is so, it is realized that he undertook a task about which a great deal has not been known. The exact nature of the relationship between logic and language has not been evident to logicians such as Russell³, users of logic such as Woodger⁴, nor to linguists such as Chomsky⁵ and Bar-Hillel⁶.

One piece of work by Reichenbach, the study of tenses, is of stimulating interest, but it does not directly concern this section and so has been left aside. Concentration is centred upon the metalanguage terms which Reichenbach says are to replace traditional word classes. These are arguments, functions and logical terms, which will be treated in turn to find out their English interpretations.

11.02 The calculus of functions can be approached in two ways. (1) As a mechanism which expresses the basic structure or language rules of Indo-European languages. (2) As a mechanism of a deductive kind which constitutes a language in its own right, and which has its own grammatical rules. It is entirely without reliance on

natural language in structure, but may simply use or not use natural languages as interpretations of it as desired.

Both these approaches are prominent in the work of logicians; but neither is satisfactory. If we start with (1) we can see that the historical associations in the development of logic out of Indo-European languages have been a cause for such a view. Thus the calculus is commonly used to formalize Indo-European sentences. Again, consider that the Indo-European feature, the verb, is needed to define what is a sentence in the calculus.

But it is hoped that the following work on arguments, functions and logical terms will show that in fact, recent logicians have taken only an amateur interest in natural language structure and that logic does not correctly represent its syntax rules.

If we then consider (2) we can find that the calculus is not independent in nature, for an Indo-European language such as English can be shown to be linked into its structure. This dependence on a source language can again be shown to have its cause in historical development⁷.

The following chapters should make it clear that the non-constant nature of the calculus formulas demands knowledge of English sentences and sentence types before interpretation can take place.

11.03 Features of the use of the argument, function and logical terms can now be summarized and related to previous remarks.

Firstly, there is not sufficient definition of the English syntax characteristics of the terms (nor is there always a non-arbitrary use of meaning concepts which define them). We can be confused over the differentiation of one from another. Thus for instance we seem able to find functions where Reichenbach has not necessarily specified them, and first type functions are difficult to separate from events.

It becomes fully evident also that Reichenbach pays no real attention to finding out whether a meaning is expressed only in a syntactic manner or in a semantic manner. Thus he includes English object-language material in the characteristics of the various terms which are supposed to belong to the metalanguage. For example, the use of thing-splitting and event-splitting results in two structural units in the calculus where English only has one. (Occasions when to use either can sometimes be difficult to decide as well.)

A curious practice occurs in the solutions to exercises which Reichenbach supplies. Here there is the introduction seemingly at will of arguments standing for series of words, which can be broken up into other

arguments and functions which most frequently arise not directly from an original sentence, but from meaning equivalents of parts of it. Thus a structure need not even appear in a sentence said to be formalized.

Although Reichenbach says that functions of higher type are not always easily distinguishable from those of lower (E. p.306-p.307), his attempt to handle the problem is not adequate. The treatment of the type level of adjectives and the sub-division of them into different kinds gives rise to numerous doubts. The general practice of discovering higher level functions to which first level functions belong, simply through meaning analysis of the words which provide the first level functions, creates not only incorrect syntax analysis, but unnecessary complication in the calculus formulas as well. The symbol f is made a constant instead of a variable and no signals of this difference are clearly outlined; ambiguity in interpretation of formulas results.

Logical terms receive some valuable attention from him, and remarks are made which link with views in this paper. But unfortunately he becomes rather generally confused through meaning analyses. It is hoped discussion in the following sections will be of clarificatory interest. Thus for example it will be held that brackets, commas, and symbol-order in the formulas are non-constant and that

object-language elements are also used.

The discussion about semantics and pragmatics may also arouse further considerations.

11.04 Faults in the formulas which arise from the uses of the terms can be observed. Firstly, more than one formula can represent an English sentence type, thus creating redundancy. But the really important fault, which has been suggested briefly in 11.03, and which requires stress, is that one formula can represent more than one English sentence type and therefore become uninterpretable on any given occasion.

Uninterpretability is also due to the fact that most functions are merely abbreviations of English words (not word classes). They are consequently meaningless in the calculus without knowledge of the English sentences in which they originally occurred.

Since we thus have object-language elements such as t for tall in a calculus formula which also attempts to represent the grammar of English through such concepts as argument and function, we can see there is an attempt to re-express the information of the object-language in a new grammar. This is in the nature of translation.

Two observations can be made. Reichenbach holds that "logistic grammar" (E. p.vi) provides a preferable

means of studying English structure. But if this is so, then one can equally hold that French grammar provides a method of discovering the structure of English. Secondly, the grammatical elements of the logical language such as functions and arguments do not even exist in their own right as French ones do, because the expressions in which they occur are not comprehensible without knowledge of English grammar and vocabulary.

The calculus thus appears as a kind of super-structure placed on the English language. It is dependent, not independent, because its structure is not properly established. It can therefore be recommended that logic concepts should be framed into English syntax, or else that English syntax be framed into logic. The result would be much the same - a full knowledge of English syntax would be made essential.

The nature of logical deduction in relation to English and other Indo-European languages would also be brought out. Since it holds certain semantic values of English constant, it provides empiric deduction within the structure of the natural language.

Some logicians might argue at this point that English and other natural languages use expressions with ambiguous meanings and that it is the task of logic to extract the specific meanings and express them exactly

in formulas which can have no alternative interpretation. While it is true that there are expressions of English which are ambiguous (since a more precise meaning is not here desired) it is also true that these expressions can still be turned into others in English where both the syntax and the semantics make quite precisely clear what any logic expression makes precisely clear. (Compare Quine in "From a Logical Point of View", p.106⁸. Note that he also says that a natural language provides a means of working with logic expressions.)

However, it may be more convenient at times (i.e. less clumsy) to keep the original English expression and introduce an extra sign from symbolic logic to denote the precise meaning desired.

11.05 In support of the view that the functional calculus is a superstructure, it can be shown how the traditional word classes which Reichenbach tends to dismiss in logical analysis simply can not be eradicated. (Cp. E. pp.vi-vii, 251, 252, 253, 255, 299, 352.) That is, if we ask whether his new logical classes are defined without any prior consideration of the word class forms of traditional (or recent descriptive) grammar, the answer is in the negative. Consider for example that event-splitting is extremely dependent on knowing whether a word is a noun (which ought to be one of a special kind). Numerous

direct dependences on word class knowledge could be quoted.

The question consequently arises of how basic the concepts of argument and function (and function level) are in English. Do they have much meaning apart from the syntactic structures such as noun or noun phrase, adjective, verb or verb phrase, with which they are correlated? Are they concepts which are independent of Indo-European language structures?

The answer appears to be yes if we can say: (1) an argument is equated with a thing which can be defined as an event considered by a speaker to be perceptible to the senses over a given limited space-time range; and (2) a predicate is equated with an event which has no specified space-time limits. It would therefore include both verbs and adjectives. (Cp. E. p.266 foll. on individuals)

However, there are shadings between these two categories, for space-time limits can be partially or vaguely given. Logic can then become confused in its use of terms. Thus for example They reddened the house with clay provides a predicate reddened, but The redness of the house was caused by this use of clay appears to offer an argument despite the claims of logic that redness is non-existential (with which we disagree) and therefore a predicate. Again, consider The house was painted with a plastic and The painting was done with a plastic, where

the uses of painted and painting both seem to provide event concepts. In such doubtful cases an arbitrary analysis might have to be made.

As discussion with F.W. Harwood has pointed out, - it does not seem possible to have a natural language at all without concepts for things and events. Therefore, the logical concepts of argument and function can be said both to be independent and also to be basic in English.

Nevertheless it can be held that their definitions have not been quite precise enough, nor the stipulations of their use quite precise enough, to avoid flexibility and non-absoluteness in analysis of English. Their meanings have not always been sufficient to determine of themselves what sequences will and what will not satisfy them. Perhaps this is because they are concepts historically associated with comparatively undeveloped Indo-European language analysis, where neither the meanings of the concepts, nor the elements of the structures with which they have been linked have been finely described.

1. Consider Jespersen, Otto, The Philosophy of Grammar, (London, G.Allen and Unwin Ltd., 1924), pp.47-55, p.345.
2. Reichenbach, Hans, Elements of Symbolic Logic, (New York, MacMillan, 1947). It will be common to refer to this book by the initial E.

3. Russell, Bertrand, An Inquiry Into Meaning and Truth, (London, G. Allen & Unwin, 1940).
4. Woodger, J.H., The Axiomatic Method in Biology, (Cambridge, University Press, 1937).
5. Chomsky, N., "Logical Syntax and Semantics", Language, 31 (1955), p.36 foll.
6. Bar-Hillel, Y., "Logical Syntax and Semantics", Language, 30 (1954), p.230 foll.
7. It will be seen from the work of Rosser, J.Barkley, Logic for Mathematicians, (New York, McGraw-Hill, 1953), that a logical calculus could be made independent of a natural language. While no full analysis has been made of his language, it yet appears that the functions and relations are here limited to special kinds, and that every sign for either can be individually defined. Thus, if his language is independent, it is so because variability has been eliminated by the introduction of rigidity.
8. Quine, W.V.O., From a Logical Point of View, (Cambridge, Mass., Harvard University Press, 1953).

CHAPTER 12.

ARGUMENTS.

12.0 Introduction.

A beginning will be made with less important matters and major ones will follow. Nevertheless, although some of the problems concerning "proper names" and "space-time arguments" are not as far-reaching as those concerning noun expressions in general, the point that these terms rely upon non-syntactic material for their definitions, applies also to other terms of the calculus and is of general significance.

When we proceed to definite and indefinite descriptions, which cover a considerable amount of English material, it will be seen that exact syntactic definition is not sufficiently given. Definite descriptions for example are not always easily separated from proper names, and indefinite descriptions are not always easily separated from the ordinary specialization of a variable. If more syntactic information were gathered, then it would not be difficult to straighten out these and other problems to provide neat definitions if still required.

More far-reaching, are problems concerning thing-splitting and event-splitting and the argument terms which result. These two activities raise questions concerning

the syntactic nature of noun expressions as opposed to verb expressions, and concerning the clear representation of the expressions in a calculus.

Firstly, once again, thing-splitting and event-splitting are not purely syntactic activities, since meanings which do not belong necessarily to any syntactic unit (i.e. grammatical category) are used¹. Thus, for example, in thing-splitting, a non-syntactic meaning equipment of a single syntactic unit or free form of English is split into two parts and given exactly the same notation as a genuine word order form. Secondly, the occasions when either kind of splitting is to be used are not clear since syntactic definition is lacking. And thirdly, the formulaic representations of both do not precisely identify what particular features of English syntax are to be used to provide an interpretation of a given formula. Invalidities of structure and confusion result.

12.1 First Examples.

12.11 To begin with, it is said that a proper name, x₁ for example, is "a symbol co-ordinated by definition to an individual thing" which must exist (E. p.255). Fictitious names are to be expressed differently (E. p.256). The insistence on existence thus demands that a certain meaning value of words must be formalized even though it does not reach the status of a single grammatical

category in English, and occurs there within the larger meaning category of proper nouns.

On the other hand, the forms which could show how a word signifies an individual thing are not explored. Consider that proper names use capital letters, that they are singular nouns, and that, like mass nouns, they do not require the use of a member of the t class, such as the or a, before them.

12.12 The use of space-time arguments symbolized by s and t (or, as in the solutions (E. p.417 foll.), by x₁ etc.), is equally dependent on semantic knowledge (E. p.259). Space-time values occur in syntactic classes which contain values with other meanings. In addition, they occur in a number of different syntactic classes, and Reichenbach does not discuss which ones should have the argument formalization. For example, in John met Jeanne in Hollywood on Tuesday at 8 p.m., space and time are indicated by in and on as well as by Hollywood and Tuesday at 8 p.m. But it is only the two last expressions which are treated as arguments. Lastly, whether a word sequence such as Tuesday at 8 p.m. is always to be treated as a totality is nowhere explained.

Although the solutions to exercises (E. p.417 foll.) on time arguments do not show prepositions formalized as t and s indicators, no knowledge of what particular English

forms are to be defined so, results. In fact, the words which are treated as time arguments are more diverse.

12.2 Descriptions.

12.21 The previous examples have been used as an introduction to a more important discussion about definite and indefinite descriptions. If we were to compare Russell's² and Reichenbach's discussions of their nature, it would be found that the lack of attention to English structure can cause some enquiry, especially as individuals occur so frequently. This does not deny, however, that Russell's work on definite and indefinite descriptions has been of considerable importance in elucidating meaning values of English sequences. The following remarks merely point out the need for refinement.

Reichenbach says that every definite description "is given by a predicate whose extension is one individual". (E. p.257). It is symbolized $(\iota x) f(x)$ (using the iota operator of Russell, E. p.258. See also E. p.261, formula 1). They are subdivided into two kinds: one, where a predicate, or combination of predicates is satisfied by only one thing, and another, where in addition to a predicate, the description contains a proper name through which reference is made to another individual.

Ex.: The first man who saw a living human retina.

John's house.

The ship in which Columbus sailed to America.

The use of a description is invalid if there is no individual satisfying it. E.g., "King of France" is invalid now, and it is said we must not state existence for the expression by preceding it with "the". If the is so used, then the sentence in which it occurs is to be considered false.

We may also compare with this, Russell's following remark:

"Max Moore points out, quite correctly, that the theory of descriptions does not apply to such sentences as the whale is a mammal. For this the blame lies on the English language, in which the word the is capable of various different meanings."² (p.690)

Remarks of this kind illustrate a surprising refusal to accept that English rules have nothing to do with external standards. The can, for example, as in The King of France case, precede any existing or non-existing individual according to contextual structure, and it is left to semantics to indicate fiction or non-fiction, truth or falsity.

Again, Reichenbach's objection to the minister of England made a speech can be dismissed, even though more than one minister of England exists. (E. p.258). It can be perfectly correct, because context usually gives the one of its main valid functions, i.e., to refer to an already identified individual. Reichenbach himself points this out in discussing another sentence on the same page. The use of a minister of England made a speech, could cause failure in communication.

Although the plurality of the is condemned on E. p.258 because the should always exclude the case of more than one satisfying individual, on E. p.263 it is contradictorily permitted when generality is expressed. The lion is a ferocious animal is said to equal All lions are ferocious animals and should be formalized according to the second expression.

But the basic problem of how we know that this last use of the is different from the first is overlooked. Indeed, the very same sentence may on occasion refer to a particular lion, and is not to be interpreted as a description of a class. Semantic value of context as well as structural sequence running over more than one sentence is probably important here.

Another important formal fact is that a definite article is not always required to provide a definite

description, as in George VI is king of England, or as in appositive phrases. (E. p.258). Reichenbach's recognition of this provides valuable information about the meanings of certain syntactic sequences, but also points to the need for further exact knowledge. As it is, imprecision leads into questioning why, for example, the use of the before river in Pharaoh dreamed that there came up out of the river seven kings, should not be treated as providing a definite description in solution 49 : 4, while the before hamlet in solution 50 : 6 is treated so. (E. p.432). Consider also solution 20 : A : 3, where no definite description is given for The soldiers followed the order of the general. (E. p.427).

12.22 Another problem concerns the differentiation between those expressions identifying one individual which are proper names, and those which are not. This arises because a proper name may consist of more than one symbol.

"Many proper names are originally descriptions, the meaning of which later has been forgotten, such as 'Leonardo da Vinci', 'Edward the Confessor', 'Smith', The line of demarcation between proper names and descriptions can therefore not always be clearly drawn." (E. p.260)

(See also solutions to exercises E. p.417 foll. where proper names consist of more than one term.)

Although an attempt is made to establish a meaning difference (E. p.259), it cannot be accepted. A proper name is said to be the sign of a thing, while a description adds to the sign synthetic information which may be true or false. (Of course, if the information is false, then the description is held to be used improperly.) Since a proper name, as a sign of a thing, must necessarily carry synthetic information too, no difference is shown. For example, London carries the information that it is the capital of England.

The constitution of a definite description could quite easily be neatened, and it has been pointed out to me by F.W. Harwood that it appears to have a close similarity to certain right expansions of nouns.

12.23 Indefinite descriptions formalized $(\exists x)f(x)$, assert existence but do not supply the uniqueness of definite descriptions because they use the indefinite article. E.g., a man answered Peter. However, it is difficult to see how to separate them from expressions which provide an ordinary specialization of a variable. (Compare E. p.86 and p.90 (containing formula 5) with E. p.264 and p.265 (containing formula 22).) So it seems that alternate ways of formalizing the same word sequence result.

Again,

"Like the definite article, the indefinite article is sometimes applied for the expression not of existence but of generality; in this meaning it does not represent a description but has the meaning of any."

Although there is a reference to E.(21 to help us find out when this is so, the grammatical characteristics remain obscure as in the case for definite descriptions.

12.3 Thing-splitting.

12.31 More crucial and far-reaching problems now arise. These concern the treatment of noun expressions in general, and consequently if formalizations here provide ambiguous natural language interpretations, then a central part of the artificial language falls apart.

Two main modes of treatment, (1) thing-splitting and (2) event-splitting, provide focus.

12.32 In discussing thing-splitting we first need to refer back to Reichenbach's chapter headed "The Simple Calculus of Functions". Here the nature of a one place function, i.e. a proposition, is described. It consists of argument-name plus function-name linked together by parenthesis. (E. pp.80-2.) In ordinary language, it is said, the relation between the two parts is usually given

by word-order using the verb to be, with the function-name usually following. (E. p.81) Thus Aristotle was a Greek provides us with a one place function having the form f(x).

Other sequences however, are also to be described as instances of f(x). (E. pp.83, 84 and 251.) They are of the form

$$\begin{array}{c} \bar{n} \\ \quad s \quad o \\ (t) \ n+o \ v+s \end{array} \quad (\text{Tom works. The fire burns})$$

$$\begin{array}{c} \bar{n} \\ \quad s \quad \quad v+n \\ (t) \ n+o \quad is \quad a+o \end{array} \quad (\text{The table is round})$$

$$\begin{array}{c} \bar{n} \\ \quad s \quad \quad \quad s \\ (t) \ n+o \quad is \quad (t) \ n+o \end{array} \quad (\text{The building is a house})$$

But the practice for first attention is the division of every traditional noun whose reference is to a physically existing object, and whose use in a sentence is of such a kind that it can be considered an argument, into two meaning categories. One is thing, receiving argument formalization, and the other is property of, receiving function formalization. (E. pp.88-9 and p.425 foll.) So for the two place function sentence All men have a father the formula provided is

$$(x) (\exists y) [m(x) \supset f(y,x)]$$

where m stands for man and f for father. (E. p.100.)

The solutions to exercises show this splitting of nouns into thing + function form quite consistently. There

may be an occasional lapse elsewhere (e.g. E. p.99, formula 14, where one noun is split and the other is not), but it can be understood that wherever $x...n$ occur, then we have formalized a partial meaning of a noun, or else reference to an existing thing which can be drawn out of an English sentence, (e.g. E. p.431, 48:5), and not a word or morpheme of English which itself entirely provides an argument. (Cp. 12.11.)

On the other hand, where $x_1...n_1$ occur as the argument terms, we do have nouns, proper nouns and also long noun phrases formalized as complete arguments. (See E. p.430, 47:2 and 47:6.) (The noun phrase need not occur in the given sentence to be formalized, but may be an equivalence worked out from it. E.g. E. p.435, definition of x_1 in 53:6). This is because any $x_1... n_1$ is simply a term for a fuller expression.

E.g. $x_1 = (\lambda x)g(x)$ (E. pp.90, 413.)

$x_1 = (\lambda x)w(x).rf(x,y)$ (E. p.435.)

So x_1 , combining thing plus function meanings, can only be used when an individual is in some way given specification in the natural language, and when an x definition is supplied for it. But some special terms, proper-names and "token-reflexive" words, can be formalized as $x_1... n_1$ without definitions. (Compare solutions 17:2, 18:B:1 and 18:B:2, with solutions 47:6, 47:8 and 51:B foll., E. p.425 foll.)

Clearly, there are illustrations in the last paragraphs of translation and not formalization. But the main question to decide now is whether formulas using \underline{x} and \underline{x}_1 , can be interpreted with clarity. Let us take the formula

$$(\exists x)sn(x) . f(x) \quad (\text{E. p.431, 48:5.})$$

representing Some snow falls. The use of the same value \underline{x} twice, indicates (1) that there can be only one noun used with a verb, or (2) that there can be only one noun used with a verb of a special list, plus an adjective or past participle, or (3) that there are two nouns referring to the same thing but having different meanings, again used with a verb of a special list.

In (1) we do not know which instance of $\underline{f(x)}$ provides the noun. We could establish the rule that the first instance is always to do so, and thus arrive at Some snow falls when the \underline{f} of $\underline{f(x)}$ represents a verb. But without such a verb consider

$$(\exists x)b(x) . g(x)$$

standing for Some boxes are green. Some snow is dirty could satisfy (2). Then again, consider

$$(\exists x)w(x) . g(x)$$

standing for Some workmen are grocers. Some snow is ice could satisfy (3).

In other formulas \underline{x}_1 presents similar difficulties, because every time \underline{x}_1 is defined it uses instances of $\underline{f(x)}$.

When it is not, we have a choice between proper nouns and "token-reflexive" words. (E.g., E. p.434, 51:B:3)

12.4 Event-splitting.

12.41 An understanding of event-splitting depends upon some ideas drawn by Reichenbach from physics. He claims that whether a piece of furniture, for example, is treated as one individual thing with a single term for its name, or whether it is broken up into several parts or even into atoms, with a term for each part, is an arbitrary convention. Again, it is an arbitrary convention whether, as in physics, it is considered a class of events.

Such event individuals, he says, may become important in daily life, and so speech has developed "designations" for using them as arguments, that is as individuals. For example, it is held that earthquake, coronation and accident are words for events and not things, even though speech treats them as arguments. (E. p.266-p.268.)

"Now it is frequently possible to eliminate event arguments. Our first instance /The coronation of George VI took place at Westminster Abbey/ for instance, can be stated in the equivalent form: George VI was crowned at Westminster Abbey. This indicates that there are two ways of formalizing a whole situation: as a 'thing-splitting' or as an

'event-splitting'. In one, the situation is conceived as an object with a property, while in the other, it is conceived as an event with a property." (E. p.268.)

Thus $f(x_1)$ which denotes George VI is crowned can be replaced by $g(v_1)$ denoting the corresponding event function.

$$\underline{f(x_1) \cong g(v_1)}$$

" \cong " denotes adjunctive equivalence, v_1 denotes the event, and g the event property coronation of George VI which is a function of both the argument George VI and the predicate is crowned. (E. p.268-p.269.) The function g may be written in the form $[f(x)]^*$ which represents transition from thing-splitting to event-splitting. Then $g(v_1)$ is replaced by $[f(x_1)]^* v_1$.

Consequently an event-word such as coronation is split into two meanings with (1) the event as argument expressed v_1 and (2) the property of the event, i.e. the activity (e.g. coronation), expressed as part of the function f .

"The argument v_1 ... is the name of the event which has the property $[f(x_1)]^*$ and which is determined if both the predicate is crowned and the argument George VI are given. Usually v_1 is given by a

description, not a proper name." (E. p.269.)

The function $[f(x_1)]^*$ is to be called a fact-function, since fact is considered synonymous with event.

These procedures appear to be odd because they again exemplify translation from English instead of formalization of it. Coronation is deprived of its syntactic status as a single semantic value of a word class, and is turned into quite different semantic and syntactic units. It becomes part of v and part of the fact-function. Thus

$$(\exists v) [f(x_1)]^* (v)$$

represents The coronation of George VI took place. (v₁ is omitted in the text E. p.269.)

12.42 We may now discuss what types of English words or word sequences can provide event-arguments (and thus fact-functions). For this, a brief description of an event argument can be conveniently extracted from Reichenbach's work (E. pp.266-268 and p.273) and from 12.41.

(1) It is drawn from any noun or noun expansion that may be considered an event which is not a comparatively permanent complex of matter (e.g. automobile accident, water particle). (2) When it occurs in a proposition, the proposition can be replaced by one using thing-splitting, for $f(x_1) \cong [f(x)]^* v_1$.

(1) may be discussed first. It provides that impact, event, coronation, etc. are to be held as events,

but leaves hospitalization, encouragement, duplication etc., as questionable cases, since it is not easy to draw a line between a long and a short duration of events. The resulting activity e.g. could be either a long or a short one.

The distinction between a definite description and an event construction is therefore brought into question. While the coronation of George VI is given an event construction, what should be the representations of the equalization of numbers, the sum of our activity, the resulting activity, etc.?

Syntactic problems also arise. When coronation, hospitalization, destruction, equalization, encouragement, etc., occur in constructions providing mass nouns (for example - is not desired or - is evil), it would appear that they cease to be events, whereas if they are preceded by a determiner they become so. As mass or abstract nouns, the references of the words above would also very likely be considered fictitious. If so, then they would receive the form of functions used as arguments, for words without reference to physically existing objects are never to be called arguments of the event type, but must be placed at a higher type level.

It is apparent then, that mere inspection of the words themselves, gives no sound guide to their formalization.

(2) A feature of event-arguments is that they may be used in event-splitting noun sequences which have no verb equivalent forms. For example:

- (a) The coronation of George VI
 = (b) George VI was crowned
 (c) He was in an accident
 / (d) He accidented

Now it is said that it is frequently but not always possible to eliminate event-arguments and to give them the thing-splitting form used for example in (b). But the equivalence

$$\underline{f(x_1)} \cong [f(x_1)]^* v_1$$

must hold always and therefore permits (d).

To prevent $[f(x_1)]^* v_1$ from generating invalidities, the transformation should have been restricted to uses of Jespersen's nexus and agent nouns, or put in another way, to uses of nouns which have their bases used as verbs in equivalent constructions.

12.43 There are also other features of event-arguments which concern what types of English expressions satisfy them. (3) We have seen how the left hand side of the equivalence in (2) can replace the right. But the right can also replace the left, and a thing-splitting proposition can be turned into an event-splitting one. Thus the verbal or functional part of a thing-splitting

can be turned into a noun expression giving rise to a fact-function. This can be done whether there is an English noun conversion of the verb or not.

For example x is married turned into the being married of x becomes symbolized $[(\exists y)m(x,y)]^*$ where m stands for married and y stands for the person x is married to.

(E. p.271). Again, Peter believes that John was killed is formalized by first taking John was killed as the being killed of John, noting it as p^* (i.e. a proposition using a fact-function) and then by writing the whole sentence as

$$(\exists v)_{\underline{L}}bl(x_1,v) \cdot p^*(v)$$

(L stands for logical possibility. E. p.277.)

And again, since there is a rule that that introduces a sentence as an event (E. p.272), Petersaw that the cat jumped down is to receive the formalization of Peter saw the jumping down of the cat. However, both the last sentences mean the same referentially as Peter saw the cat jump down, and the first has the same word class and constant pattern as Peter said that the cat jumped down. It is by no means clear whether these last are to be treated as containing event-arguments, and problems of recognition arise as in (1).

(4) It is evident from (1) and from succeeding sections that finite verbs and finite verb phrases are not considered forms providing event-arguments. This appears

a little strange, as there seems no reason why verbs such as likes in Mary likes this sunny day, or is working in John is working, should not be treated as individual events.

However, the infinitive in a few of the solutions (E. p. 436, 48:3, 48:4, 49:3, 54:3) does provide an event or fact formula. Johnny likes to drive his car is symbolized

$$\underline{(\forall)[d(x_1, y_1)]^* (\forall)} .$$

12.44 The two preceding sections illustrate that arbitrary choice is included in the decision to call some English expressions event arguments, others thing arguments and others functions. As Reichenbach shows, a noun and a noun phrase can refer either to an event or a thing. So, it appears that as it has been traditional to derive arguments from nouns, the event meaning provides an argument also. But since it has been traditional for verbs to provide functions, event-arguments are not derived from them although this could be done. The decision whether to do so or not is quite arbitrary.

We can loosely distinguish a thing from an event in sense data and consequently disagree with Reichenbach that the habit of using one term rather than another is purely conventional. A thing may be described as an event which appears to an individual as essentially remaining the same over a given period. An event, however,

shows appreciable change. (A clearer line could probably be drawn between the thing-splitting and event-splitting nouns discussed in 12.42 (1), even though dubious cases will remain.)

But the distinction of meaning is only one feature to be looked for in putting sentences into the calculus. The distinctions of the word classes must also be found, since the rules of formalization are linked with them most clearly, and also arbitrarily.

A minor example can be developed from the following: "the impersonal use of it usually indicates reference to an event argument, as in it was my tenth birthday."

(E. p.272.) For recognition of when it is impersonal, we have to examine what other words combine with it to make it so. Then, in formalization, we have to accept the rule that such use provides an event argument, for a time argument could equally be derived.

12.45 It is also apparent from preceding sections that because meaning analyses do not eliminate choice in formalization of sentences, and because the arbitrary rules concerning the word classes have not been worked out fully enough to do so, we must enquire whether the selection of forms for a given sentence leads to confusion.

That a many-one relationship holds would not matter if it merely meant that the many were exclusive to the one

sentence pattern. But it has been seen that a formula for one type of sentence can be used for another or even more, and consequently alternative syntactic interpretations for the formula arise. Thus, e.g.

$(\text{Ev})[f(x_1)]^*(v)$ = The man died
The dying of the man is ended
George VI is crowned
The coronation of George VI took place
The box is round (Since $f(x) = n$ is a)
The roundness of the box exists
It was Thursday
The cat jumps
The jumping of the cat takes place
John is married
The being married of John exists
He was in an accident
He accidented etc.

Interpretation is impossible unless we first know the sentence being formalized, and thus the use of the starred formulas at all becomes of questionable value. (Consider also whether the formulas in E. p.270-p.271 are interpretable when isolated.)

12.5 Minor Points.

Other important problems about arguments are concerned with the precise statement of what circumstances

make a noun an argument instead of a function so that it can be subject to splitting. But they will arise in the following chapter and are not repeated here.

It is also more convenient to discuss when functions are used as arguments in the next chapter too.

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1. The notion of a grammatical category adopted here is that it is a logical symbol of syntax with a particular meaning (or meanings).
 2. See Schilpp, P.A., The Library of Living Philosophers Vol.V. (The Philosophy of Bertrand Russell), (United States, Northwestern University, 1944): the article by Moore, G.E., "Russell's 'Theory of Descriptions'". It contains not only discussion of the theory, but also references to where it is put forward by Russell. Compare also Russell's reply to Moore in this same book, p.690 foll.

CHAPTER 13.

FUNCTIONS.

13.0 Introduction.

13.01 The chapter on functions will follow through with some ideas established in the previous chapter.

(Since Reichenbach's chapter devoted solely to the simple calculus of functions is involved, some remarks will be drawn from there. It is to be noted that the term "function" is here used synonymously with Reichenbach's terms "function-name" and "predicate".)

For example, one-place functions can be found in more syntactic sequences than Reichenbach recognizes. Again, although some semantic criteria for the recognition of two-place functions can be eliminated, semantic elements still provide a major point of criticism. Methodology becomes confused because syntactic elements are not differentiated from them.

Some new points, however, are made. Examination of Reichenbach's formulas shows that most function symbols are just abbreviations for English words, and consequently meaningless within the logical language unless the English words for which they stand are known. This makes the logical language dependent, not independent, and it can be said the calculus is just a kind of translation, not a

formalization at all. Certainly, if individual word values, and not simply their structural nature is formalized, it is hard to pin down just what "logical grammar" is or ought to be.

Then another problem is considered which concerns syntax only. If formulas of the calculus are ambiguous in interpretation so that the English syntax sequence to use on a given occasion is not clear, it can be suggested that more knowledge of English syntax can be introduced into the formulas to make them non-ambiguous. But if this is done, the calculus symbolization will grow closer and closer to an English grammatical symbolization.

Whether it would be better to turn the concepts of the functional calculus into an English syntax notation, or to turn English syntax into the existing notation of symbolic logic might be a matter of choice. But something needs to be done. Multi-place functions for instance have extremely diverse interpretations.

13.02 In treating specific features of functions, the idea of complexity is taken first. A complex function is not described most precisely by Reichenbach. He stresses meaning concepts which bear upon recognition and provide some syntactic criteria. Another criticism is that Reichenbach allows a sentence to be treated as containing complex or simple functions as the logician wishes.

Consequently Diversity of IC analysis for any one sentence is created. The diversity of interpretations for both $f(x)$ and $f(x,y...n)$ are also increased, but no further ambiguity is created unless the definitions of the complex functions are lost.

The whole idea of contractions, or complex functions, reduces to some extent the formal importance of both one and multi-place functions. $f(x)$ with definitions is now interchangeable with $f(x,y...n)$. The definitions unfortunately could lead to the finding of meaning equivalences for an English sequence, and not to analysis of its structure.

This same problem arises, too, when Reichenbach recommends that certain single words which appear to be simple functions (e.g. successful), should be treated as complex ones, because they can be given a meaning analysis which shows that other functions or arguments are entailed. It will be found that attempts to discover such meaning equivalences can lead to absurdity. (See 13.22.) We would prefer to dismiss meaning treatments of complex functions as they give rise to much arbitrariness.

Reichenbach does, on the whole, avoid complex functions in his solutions to examples of conversational language. However, he exhibits the frequent use of contractions for arguments. A great variety of syntax

sequences are covered by x_1, y_1 , etc., which seem to be introduced at will. Therefore, the possibility of no proper record of syntax which is discussed concerning contractions of a function kind is here realized for contractions of an argument kind. The definitions of the contracted arguments most frequently arise from finding meaning equivalences for parts of the original English sentences. An $f(x)$ formula can therefore represent a sentence which may or may not occur in a given text, and structural analysis is neglected.

The second specific feature of functions discussed is their type level. Some problems are raised, but the bulk of the work on type level is given in the next two chapters.

Firstly, it is hard to separate functions of first type from events. English indeed, makes no syntactic differentiation between nouns which satisfy these different logical concepts. However, if events were to be derived solely from nouns which can have a verbal conversion in the manner of the nexus and agent-nouns of Jespersen¹, then analysis would more closely approach correct English grammatical description.

Reichenbach says that with regard to descriptive functions it does not matter whether event-arguments are confused with them or not. We cannot agree, for if this

is accepted, then more confusion of interpretation is added to already overloaded formulas. More syntactic distinctions are lost.

13.1 Basic Views and Criticism.

13.11 The first functions to be identified are those of the one-place kind. They are described as usually being nouns or adjectives following uses of the verb to be when it is preceded by an argument. (E. p.81, p.299.) However, intransitive verbs following an argument as in e.g. n v+s also belong to them. (E. p.251.)

In addition, we have seen how thing-splitting and event-splitting supply functions; and it will be seen later that certain different sequences of morphemes can supply complex one-place functions too.

Some questions will now arise. Consider that transitive and intransitive verbs are involved in the following stroke-enclosed phrases and that it could be suggested they supply one-place functions. (Cp.13.12.)

I / will ring up / tomorrow.

I / am going to call in./

/ Will / you / come?/

We can also recall problems in Chapter 12 about when thing-splitting and event-splitting can occur to provide functions of arguments, and we will see further problems over complex

functions, type level, and so on in further work.

13.12 For multi-place functions, descriptions taken directly from Reichenbach's book will be appropriate.

"Among the two-place functions verbs dominate, as all transitive verbs with one object fall into this category, like \hat{x} sees \hat{y} ; but we include in the two-place functions also verbs connected with a second argument by a preposition, as \hat{x} speaks to \hat{y} , \hat{x} differs from \hat{y} , which grammarians classify as intransitive. It may appear advisable, though, to regard the compound expression speaks to, differs from, as the propositional functions. Adjectives in the comparative degree belong to this group, such as used in the function \hat{x} is taller than \hat{y} ; however, we also find here adjectives in the positive degree, such as \hat{x} is similar to \hat{y} . Among nouns belonging to this group are the family-relation terms, such as \hat{x} is the mother of \hat{y} ; another noun example of this group is \hat{x} is an antagonist of \hat{y} . Three-place functions are mostly verbs, namely, those with two objects, such as occur in Peter sends a telegram to Paul, where Peter, a telegram, and Paul are the arguments, and sends is the function. An example with a noun as three-place function is the statement this book is a present from John to Mary, which has the form \hat{x} is a present from

\hat{y} to \hat{z} . Among these functions we find also the word between, which grammar awkwardly classifies as a preposition, for \hat{x} is between \hat{y} and \hat{z} is a three-place function." (E. pp.251-252.)

In this, there is again a mixture of considerations of structural aspects of words in sequence patterns, and of individual semantic word values. However, the call to inspect individual words such as mother and so on to see whether they are two-place functions, could probably be replaced by a call to examine syntactic features instead. For example, let us consider all instances of

t n of (t) n

as two-place function descriptions of individuals. The decision could be an arbitrary one but at least it would be consistent.

The word between need not necessarily be retained either, in order to specify three-place functions. The forms

(t) n+s (t) n+s (t) n+s
t n+o BE p t n+o c' t n+o

could very likely be used as general syntactic characteristics instead.

We do not accept the objection to between being described as a preposition, for the term preposition does provide an attempt to set up a class of words all characterized by their same positional behaviour. Reichenbach

on the other hand, attempts to record what he considers to be an important meaning of between without considering its positional behaviour at all, nor how this positional behaviour helps determine the meaning he describes.

The possibility of establishing syntactic criteria for other instances where meaning characteristics of individual words have been stressed needs attention. However, in other cases of functions, the importance of individual word meaning values is undeniable. We have discussed thing-splitting (existence and non-existence) and event-splitting, and will discuss complex functions and type level also.

We maintain that existence and non-existence are not to be separated into two different formal units when their meanings occur in noun form, because this form in English makes them both possible meanings of one syntactic category.

13.13 The one and multi-place function formulas, and the fact-function formula $[f(x_1)]^*$ $f(x)$ and $f(x, y \dots n)$ supply three basic means of representing every English sentence type except for those which are said to include higher functions. Consequently

$$(y)c(y) . q(y)$$

provides one instance of the use of $f(x)$, and represents one instance of an English structure such as All cats are quick.

$$(x)f(x) . g(x)$$

represents the form of the sentence, expressed in English

syntax notation as

t' n+s BE a+o

It follows that the "symbolizations" of English sentences E. p.429 foll. are consequently not expressions of their functional calculus structure (which is to replace English grammar) but re-expressions of the actual sentences themselves within the functional calculus. The translation from one language into another is not very useful, for the new signs (c) and (q) in the instance above cannot be understood unless their individual English word values are known. Put another way, these signs are meaningless within the logical language, and are merely abbreviations for English language words. They do not exist in their own right, but depend on English language sentences to be known first in order to understand them. (Cp. solutions E. p.425 foll.)

In one sense, we might just as well have written down the English sentence and ignored the translation. The value of the translation lies only in pointing out that concepts of argument and function can be extracted from the original. Other concepts could equally be expressed in some kind of notation. However, if some way could be established of knowing what (c) and (q) refer to unambiguously, then the new language could be given some support. (Cp. 20.31.)

But there are other problems in the calculus of a serious kind. It has been seen how the calculus formulas $f(x)$ and $[f(x)]^*$ are ambiguous in interpretation. So even if the question of the meanings of particular functions were to be solved, the syntactic interpretation of the forms themselves would remain uncertain. The uninterpretability of $f(x)$ could perhaps be eradicated. For example f^V could be used to show that the function of a particular argument is an intransitive verb. Then further notation could be introduced to show that the function consists of a sequence of words, such as x is sleeping or x came in (each would have to be symbolized differently).

However, the more exactitude of interpretation attained, the more the notation would include information about English word classes and constants, and the more it would become an expression in different symbols of the information conveyed by English syntax symbols such as those used in this paper.

The question will arise whether it is better to incorporate the concepts of the functional calculus into an English syntax notation, or to incorporate English syntax into the existing notation of symbolic logic. Perhaps one is no better than the other, but it appears at present that the first would produce the most immediate results and would make the functional calculus more workable as a

translation language.

What has been said about ambiguity concerning $\underline{f(x)}$ and $\underline{[f(x)]^*}$ also applies to $f(x,y...n)$. This last formula covers an even wider selection of arrangements of word classes and constants. Consider that $\underline{f(x,y)}$ can be interpreted as

$$\begin{array}{c} \bar{n} \\ \hline \begin{array}{c} t \ n+o \\ (t) \ n+s \end{array} \end{array} \left\{ \begin{array}{c} v+s \\ v+s \\ v+o \end{array} \right\} \begin{array}{c} \bar{n} \\ \hline \begin{array}{c} t \ n+o \\ (t) \ n+s \end{array} \end{array}$$

$$\left\{ \begin{array}{c} v+s \ p \\ v+o \ p \end{array} \right\} \left\{ \begin{array}{c} BE \ a+of \ than \\ BE \ like \\ BE \ similar \ to \\ BE \ (t)n+s \ of \\ BE \ t \ n+o \ of \\ BE \ as \ a+o \ as \end{array} \right\}$$

The brackets stand for the occurrence of the \underline{n} sequences shown. Compare the further diversity of sentence structures formalized as two-place functions in the following exercises and their solutions in E. p.411 foll.: 18:A:6, 18:A:7, 18:B:6, 20:A:3, etc.

So, as before, in order to be able to select from this array a structure which will satisfy an instance of the use of the calculus formula, eg.

$$\underline{(x) (y) [g(x) . h(y) > i(x,y)]},$$

the original English sentence has to be known. The formula itself loses contact, and would therefore not be useful in machines which require that lexical and structural information must be retained in some fashion.

13.2 Kinds of Functions: (a) Complex.

13.21 These are discussed by Reichenbach under the heading "Classification of Functions" (E. p.299 foll.). Here also, reference is made to the classification of functions with respect to "place properties". This is treated more fully in E. 22, but the attention given there to two-place functions is based on conceptions of meaning and not formal study. Thus meanings of individual words are examined in order to show what particular kinds of relations (i.e. two-place functions) are involved. Formulas are given to define the meaning concepts, and this allows a classification of words and combinations of words into various sub-groups of functions, but it does not analyse English structures. So "place properties" have been set aside in this paper.

The definition of complex functions as opposed to elementary ones, is however, of considerable interest. A function is to be called elementary "when the symbol f is not reducible to other symbols". It is to be called complex when it "possesses an inner structure, i.e., is defined in terms of other functions or arguments". (E.p.122).

This makes it possible to treat a great variety of word sequences as complex predicates. For example, son of William becomes a one-place function instead of a two-place function (son of) plus an argument (William).

$$\underline{g(x) =_{df} f(x, y_1)}$$

(E. p.122)

It is generally permissible to consider a combination of an argument and a predicate as a new predicate. In Peter is taller than Paul, e.g., is taller than Paul may be treated as a single complex function. And it is equally possible to consider a subject-plus-verb sequence as a predicate of an object. Thus, in John loves Mary (a two-place function expression) John loves can be treated as the function of Mary. (See E. pp.253-254.)

These habits virtually mean that every finite verb construction which may stand alone as a single sentence and which does not include higher functions, can be formalized as f(x) with suitable definitions of the function and also of the argument if it is an instance of x₁. (See 12.32.) The multi-place functions are not essential except in definitions of the kind above; and fact functions can be converted, or else treated as complex ones.

The diversity of forms which f(x) may now cover is very large, but ambiguity is not increased unless the definitions are lost. For example, John / walks slowly to the door. Mary likes / the drive into town. If, however, the multi-place analysis is chosen for these sentences, arbitrariness of IC analysis can be shown. Thus John / walks slowly to / the door, or Mary / likes / the drive / into town. This will be of interest in discussing Reichenbach's basic sentence types.

13.22 In addition to introducing complex functions for certain forms of morpheme sequences, Reichenbach also introduces them for certain meaning values of individual members of syntactic classes which occur within these forms. In this case, no syntactic criteria for identification can be established.

It is said that in x is married we can treat is married as a complex predicate because the whole sequence means There is a y such that x is married to y. The complex predicate g is introduced by the definition

$$\underline{g(x)} = \underset{\text{df}}{(\exists y)f(x,y)}$$

The bound variable y is thus an implicit argument of g(x). Similarly, x drives is held to mean There is a y, which is a vehicle, which x drives. The function drives is thus said to have absorbed "not only a bound variable, but also a predicate, namely, vehicle". (We feel that if this is so, then thing-splitting should not have been ignored for y in x is married.) The text then treats a relational product.

"This term is introduced by the definition

$$\underline{h(x,z)} = \underset{\text{df}}{(\exists y)f(x,y) \cdot g(y,z)}$$

Thus grandfather is the relational product of the predicates father and parent. Here also two predicates are merged, and a bound variable has been absorbed." (See E. pp.122-123)

The activities within this last paragraph are of a

rather peculiar nature. It follows that any function word or function sequence can be regarded as complex and therefore broken up, if its meaning includes the necessity that some other object (or objects) exists to make the word or sequence meaningful. As this is always the case, all functions need to be treated as complex ones, if Reichenbach's point of view is accepted.

For instance, take his treatment of x is successful. This is held to mean that For all y, if x aspires y, x reaches y.

$$s(x) =_{df} (y)[a(x,y) \supset r(x,y)] \quad (E. \text{ p.123})$$

"The word successful is therefore a contracted symbol standing for a combination of two predicates and a variable bound by an all-operator." (E. p.123) But the two predicates, aspires and reaches, could again be broken up in order to express their meaning, and so we could go on and on.

If this process of treating complex functions were carried to the limit then it would be necessary to reduce every noun to "a thing", with all the particular characteristics that define the noun extracted as functions, and also to break up verbs and adjectives into their relationships with "things". Then a function would not be called elementary until a relationship of some sort with "a thing" had been set up.

When, for example, John walks down the lane is to be formalized, it would be necessary to say that the meaning is that John is a unique thing such that it has two legs (plus every other property of a human being) and that it walks on the ground between two lines of demarcation etc. etc. This is quite absurd, but even if the theory is not developed to such an extent, it does enable us to treat single verbs in simple sentences as contracted symbols (i.e. complex functions). Thus the verbs in John walks and The baby talks can be treated as contracted symbols of two-place predicates, because John must walk on something, and the baby must be heard by someone for the sentence about its talking to be made.

The definitions of contractions thus involve in any formalization, sentences which do not occur in a given text. Unless special signs are put in, it will be impossible to recreate the text in its original form. There seems little point in altering the sentences into other forms with other values in the first place.

13.23 But more significant is the fact that the whole idea of contractions with definitions allows a wide variety of different formulations for one English sentence. Functions can thus be turned into functions and arguments as well, and so on. And whether a sentence is treated as a one-place function-argument sequence (i.e. $f(x)$) or as a

multi-place one (i.e. $f(x,y...n)$), is merely a matter for personal decision. (Compare remarks in 13.21.)

The result is that one, two, and three-place functions can really become equivalent formally, while their definitions only will differ. So 13.12 and 13.13 are not of fundamental importance in "logical grammar". Instead, we need to attend to the finding of meaning equivalences for purposes of definition without analysis of structure as a primary aim. (The rules for definitions would affect procedures. (See E. pp.123-124). The freedom with which we may consider a given word or sequence a contracted form is limited by the rules for their introduction, to expressions of the form $f(x,y...)$, which all the examples given here satisfy.)

13.24 The meaning treatment of a function as complex or not gives rise to such arbitrariness that we would prefer to dismiss it. It may be from similar views that although Reichenbach considers complex functions of a meaning kind with regard to the simple calculus of functions, he does not consider them with regard to the formulation of conversational language (an activity which, however, can scarcely be separated from the functional calculus.)

"We shall regard a function as simple if it is expressed by an independent word not indicating a

derivation from other functions. Thus we shall conceive, for instance, the function brother always as a simple function. It is true that there is no logical necessity to do so. Thus we could regard the function \hat{x} is the brother of \hat{y} as a complex function of the form there is a \hat{u} and a \hat{v} so that \hat{u} is the father of \hat{x} and \hat{v} and \hat{v} is the mother of \hat{x} and \hat{y} (etc.). We prefer, however, not to make a formal use of this definition. What we call a simple function, therefore, depends on the language used; when this language possesses a special term for the function it will appear convenient to regard it as a single function." (E.pp.299-300.)

On the other hand the complex functions defined through knowledge of English syntax are still to be used. (E. p.300.) This means that remarks about the diversity of sentence types symbolized by $f(x)$ plus definitions, and remarks about any one sentence receiving various $f(x)$ uses still hold.

At this point a closer inspection of Reichenbach's solutions to examples is convenient. In fact, not many complex functions are used. (An interesting one, d , occurs in 54:3, for its structural justification is obscure.) The contracted symbols which require definitions are most frequently arguments. x_1 , y_1 , etc. cover a great variety

of syntax sequences and seem to be introduced at will.

Indeed, their definitions most frequently arise from finding meaning equivalences for parts of the original sentences to be formalized. Structural analysis then is subsidiary to meaning study. An $f(x)$ formula can now symbolize a sentence which may or may not occur in a given text.

13.3 Kinds of Functions: (b) Types.

13.31 A very important division of functions is into simple and higher ones. It has already been seen that any argument splitting of a noun or a noun phrase occurs only when it refers to a thing which exists. If it does not exist, or if it cannot be reduced to some sort of physical existence (by rules we do not accept), it is to be considered a function and is not split up. (See E. p.274 foll.) This seems of very little use in any English syntax calculus, but it is a method by which symbolic logic avoids certain invalid deductions.

Such functions are to be always considered first type or simple properties, along with all other properties, existent or not, postulated about "things". In addition, there are higher types of functions, such as a property of a property, called a second type function, or a property of a second type property, and so on. For the different

types, definitions are needed which supply us with more information than the meaning distinction of existent as opposed to non-existent things, and the definitions for simple functions already given.

13.32 One difficulty is to separate functions of first type from events. It is pointed out (E. pp.271-2) that nouns of an event kind are to be considered of the same type as thing arguments; that is, they are to be considered zero level. It has been seen however in 12.42 that in certain sequences some nouns considered events in some other sequences satisfy the definition of a function and are therefore of a different type.

For example, economy / is a useful property is formulated $\langle f_1 \rangle$ (E. p.214), because economy is considered as a property used as argument, and not as a word with "thing" value. So it does not receive an event or a thing splitting, even though its syntactic form permits either. However, it does have a verb equivalent form.
Compare

(a) John practises economy

(b) John economizes

We can transform (b) as $f(x_1)$ into $\exists v[f(x_1)]^*(v)$ which is similar to (a).

But according to E. p.214, (a) should be considered a sentence with heterogeneous functions, where the verb practises is to be considered one type higher than the

highest level of the two arguments it links, and the sentence should be formulated as $f(x_1, f_1)$.

It is not at all easy to decide when a noun construction which may be turned into a construction using a verb is to be considered an event or a function. Consider

- (a) John studies every morning
- (b) John's study is every morning
- (a) The tree flowers
- (b) The tree is in flower
- (a) The electrician works at night
- (b) The work of the electrician is at night
- (a) They discovered the men with difficulty
- (b) Discovery of the men was difficult
for them

etc.

When Reichenbach observes that sale is a fact-function, without any considerations as to what type of structure it may enter, confusion is assured. (Is it also, on the meaning level, to be considered a permanent complex of matter or not? See E. p.301.)

The facts are that English makes no formal distinction between these functions of first type and events of zero type. They both behave as nouns in similar constructions. What it does distinguish, however, is the possibility of converting some nouns into verbs and vice versa, which has been treated more fully by linguists like

Jespersen. As we have seen in 12.42, event, or fact-functions could be dismissed altogether and in their place a term for a noun which has a corresponding verb form could be introduced. The arbitrary nature of Reichenbach's work on conversational language is here well illustrated. It is easy to see the calculus as a superficial structure dependent on basic features of English syntax to enable its manipulation.

13.33 The problem of whether a noun which has a corresponding verb form is to be considered a zero event or a first level function is treated by Reichenbach when he discusses the particular constructions called descripti-
onal functions. (E. pp.317-318) Here not only the forms

$$\begin{array}{cc} (t) \ n+s & (t) \ n+s \\ \underline{t \ n+o \ of \ t \ n+o} \end{array}$$

(i.e. noun patterns which therefore include event-nouns) but the forms

$$\begin{array}{cc} & \bar{n} \\ & (t) \ n+o \\ \underline{t \ v+ing \ of \ t \ n+s} \end{array}$$

and infinitive constructions (not discussed) are said to provide descripti-
onal functions or event-arguments ambiguously. It is considered, however, that "the distinction is irrelevant for many purposes".

But the alternative formulations are not irrelevant, as we saw in 12.45, when listing the possible interpretations of

$$\underline{(\exists v)[f(x_1)]^*(v)}$$

To these, we can now add John economizes and John practises economy. The last sentence thus makes the variety of fact function syntax interpretations confuse with the variety of interpretations for $\{(\underline{x_1}, f_1)\}$.

Any descriptonal function then, which is formulated in event style, can possibly have the form of any one of these sentences, and its original syntactic distinctions are lost. For example, Reichenbach indicates that the man who walks between Peter and Paul = the man walking between Peter and Paul (E. p.312.) If either is formalized in the event manner, then its interpretation can be in the form of any one of the sentence types we have listed (and more) so that invalid and nonsensical sentences result.

Similar remarks apply to the notation $f'(\underline{x_1})$, for it also includes descriptonal function and event expressions equally. For example, $f'(\underline{x_1})$ for (a) the father of x allows x_1 fathers, because (b) the dancing of x_1 = (c) x_1 dances, and (a), (b) and (c) can all be formulated $f'(\underline{x_1})$ indiscriminately.

13.34 In a quite different way, it is rather peculiar that according to the theory of functions and higher functions the words of (a) John practises economy and (b) John economizes are to be given the following type levels.

(a) 0 2 1, (b) 0 1. Why is not (a) 0 1 2?

After all, if an adjective plus noun, as in x is a slow driver, is considered 2 1, why cannot a verb plus object be considered 1 2? Why should practises be considered a property and not an activity? Does the human mind react to it as such?

That the calculus imposes arbitrary analyses of meaning upon certain syntactic features is fairly evident. There seems to be no foundation for believing that the language possesses them on the level of structural meaning, i.e., as meanings which necessarily occur every time a member of a syntactic class is used, or every time a syntactic constant is used.

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1. See Jespersen, Otto, The Philosophy of Grammar, (London, G. Allen & Unwin, 1924), various sections.

CHAPTER 14.

TYPES.

14.0 Introduction.

The attention given by Reichenbach to the separation of first and second type levels has warranted more than one chapter in discussion of them. His work centres around the adverb and the adjective and so they are also central here.

The adverb is always considered by him to be of second type, but the adjective varies according to certain conditions. These, however, are open to discussion and criticism. For example, starting from Reichenbach's own core of ideas, it can be argued that more adjectives than he describes can be called second type. Again, the type of an adjective which will not take an adverbial equivalence can sometimes not be resolved.

The question of the level of nouns which occur in left hand expansions of noun-head words also remains unresolved. (The formulas for such sequences are again unsatisfactory because they represent entirely different syntax sequences as well.)

Another criticism of the treatment of such noun expansions is that it overlooks the various meaning relationships which the two nouns can have to one another.

Allied problems concerning meaning relationships between adjectives and nouns also arise. It can be seen that inadequate attention is given to deciding whether a meaning is expressed only in a syntactic manner or in a semantic manner.

14.1 Adjectives, Adverbs and Nouns.

14.11 Reichenbach's attention centres on what he holds to be the variant level of the adjective occurring in sentences using the verb to be. The adverb however remains for him a second type function anywhere within the language. The adjective is always to be considered a first type, apparently, unless its root can form an adverb in a sentence which is equivalent in meaning to the one in which it first occurred. In this case, the adjective is said to provide a second type function.

We are to compare John is a slow driver with Royce Hall is a red building. Red is to be called an independent function and not a modifier of the noun building, because we can establish the conversion Royce Hall is a building and Royce Hall is red. Slow, on the other hand, is a true modifier of a property because it takes the conversion John drives slowly. It will not take the conversion John is slow and John is a driver. Slow is not a general property of John but a property of the property

driver. It is a second type function while red is a first.

The omission of treatment of the use of the adjective in noun phrases before or after other verbs can be justified by us, because a conversion to BE sentence patterns can be made in these instances. For example, The little boy found the small dog can be changed to The boy who is little found the dog which is small, or to The boy is little. He found the dog. The dog is small. The equivalences of course, only provide synonymy of informative or referential material. It is assumed that the adjective equivalences which Reichenbach discusses are meant to be of the same kind.

14.12 But the theory which distinguishes slow from red may be incorrect. Consider whether an adjective is an independent function, not because of the conversion given, but because the noun following the adjective states a class, or property, to which the subject belongs by definition. For example, in John is a man, man is a property of John which is provided by the meaning of the word John; but driver, in John is a driver, provides an extra piece of information not to be extracted from the word John.

Compare:

The poplar is a big tree

London is a capital city

(i.e. a capital and a city)

The eagle is a large bird

My dog is a young animal

That house is a big building

But My dog is a young pup

does take the independent function equivalence while it does not satisfy the conditions just given.

14.13 Whatever the case, which could be verified by more extensive study, more adjective expressions than those which take the adverb conversion, can be called second type functions. For example:

Rome is on low hills

* Rome is low and Rome is on hills

(There is a difficulty here in that the use of is on may make hills a zero level argument instead of a property.

In that case low is a first type. It is hard to know how to treat such a use of a preposition. Cp. formalizations of prepositions after verbs in Reichenbach's solutions to exercises.)

Better examples would be:

The room is a dark green

The book is a loose leaf one

So an adverb equivalence is not a necessary part of the definition of an adjective modifier.

On the other hand, since an adverb of the form +ly is always considered second type, any adjective which may

take the conversion to an adverb, when the noun which follows the adjective becomes a verb, must always be second type. This leads to the question: what type is an adjective which will not take an adverb equivalence when the noun will turn into a verb?

The problem is a difficult sub-division

• The problem subdivides / with difficulty /

Reichenbach has said that verb+preposition should be treated as one unit. (This does not include BE patterns.) In that case difficult is split into a zero level argument+function of a two-place verbal relation, subdivides with. What, then, is difficult in difficult subdivision? Unless the adjective is capable of taking +ly there is no resolution.

14.14 This leads into the question of how left hand noun expressions of a noun are to be treated.

Consider: The attic is a box room

The tin is a dust bin

The machine is a street sweeper

He is a lorry driver

The nouns preceding the last words of the sentences can hardly be treated either as first or as second type functions. Yet, in discussion of complex functions Reichenbach makes it necessary to treat both nouns of each sequence as instances of first level. (See E. p.309, p.123.)

Thus in x is a door bell, door bell is treated as a complex function of x and defined in this way:

$$\frac{db(x)}{df} = b(x) \cdot (\exists y)d(y) \cdot cn(x, y)$$

db = door bell

cn = connected with, belonging to

This seems an inadequate formalization of the relationships between the nouns here and in the examples above. A meaning feature expressed through special word order is given the same formalization as other two-place functions such as x loves y and x is the father of y. The formula need never lead to the use of the morpheme order n+o n+o at all.

In addition, the definiens does not hold for all instances of the sentence pattern represented by the definiendum. Although cn, meaning connected with, but not belonging to, appears to have some value as a general analysis of the meaning relationship between two nouns set in a noun phrase, the whole formula fails to express the various conversions which the sentence pattern of the definiendum can take. In other words, it overlooks varied meaning relationships.

All the above sentences can be converted into the form

x is t n+o for n+s

for n'+o (in the case of the mass noun

dust, only)

E.g. The attic is a room for boxes

But: He is a lorry driver also equals He is a driver of
lorries

Also note: The process is a laboratory discovery

= The process is a discovery by laboratories
a
the laboratory

(The conversion The process is a discovery for laboratories
the
 (or a laboratory) might be possible in some contexts.)

The holiday is a school reward
by
 = The holiday is a reward from the school(s)
for
 or = The holiday is a reward to the school(s)

This is the examination result
 = This is the result of the examination
 ≠ This is the result by the examination

The definiens ignores such distinctions which appear to depend on context for their selection.

14.15 Attention is given to another type of complex function.

".... the function the last Goths is a complex function in which last does not have the character of an adjective since x is a last Goth cannot be split into the two statements x is last and x is a Goth." (E. p.309.)

However, slow, in John is a slow driver does not fit these two statements either, yet it is considered a second type function. We would expect last to be of the same kind.

Reichenbach maintains:

"The word last stands here as an abbreviation for a qualification saying that there were no later Goths; the qualification could be easily symbolized with the help of logical terms. The word last, therefore, cannot be construed as an independent function, but must be regarded as an incomplete symbol which has a meaning only in combination with functions." (E. p.309.)

We may ask with good reason, why then, does this comment not apply to slow driver.

Apparently last Goths is held to be a complex function while slow driver is not, because last is called an abbreviation for the idea that there were no later Goths. Once again this introduces a semantic and not a syntactic value to be recognized and stated in the symbolic calculus.

14.16 One of the difficulties concerning the whole treatment of adjectives by Reichenbach in the ways just described, is that while recognizing that certain left expansions of nouns have certain equivalences while others have not, he does not examine why this is so. If there happens to be no syntactic reason why the last Goths ≠ independent function form, we must admit this relationship of last and Goths to be semantic, and put the knowledge

into the vocabulary classification system of the calculus.

There has been in the past insufficient recognition that no syntactic distinction is made for some semantic relationships between the members of a noun phrase (whether in a right or a left expansion). That is, the syntax provides no differentiation of form for a relationship which ultimately depends on words used and their context. The syntactic word order has an ambiguity of meaning, that is, it is capable of expressing more than one type of relationship, until the individual words fill the positions. This is not true of a sequence, such as t n+o v+d t n+o.

CHAPTER 15.

TYPES: ADJECTIVE DEFINITION.

15.0 Introduction.

15.01 A study of the way in which adjectives and adverbs are formalized now centres upon the three basic definitions of adjective kinds which Reichenbach supplies. All formulas provide considerable criticism.

This arises firstly because a practice is introduced which causes unnecessary complication. Its purpose is to enable formalisation of functions higher than first level (e.g. adverbs), but it appears this can be done by simpler means.

What happens is that Reichenbach claims that a first level function, e.g. an adjective or an adverb, can be given a membership as one of a class of functions at a higher level, even though this class is not directly referred to by an English word in a given sentence. The practice is therefore not related to English syntax.

In addition it alters the previous nature of f , making it a constant instead of a variable term. Thus the word move for example, is split into a part f , which merely (and in all other cases of a function) represents a specific but unknown property, and into a part, for example μ , which represents a value of a higher level function variable, in

this case the class of motion-properties.

This splitting is used to produce one of the definitions of adjectives, and not only creates unnecessary meaning analysis. It also creates formal confusion, for it is not shown that \underline{f} should receive a sign to show when it is a constant and when a variable. We can thus pick out two formulas from Reichenbach which are similar, but with \underline{f} as a constant in one and as a variable in the other. (See 15.31.)

A second definition of the adjective involves splitting into a higher property part, not simply as above, but through holding that the meaning of the adjective implies this higher and quite separate property as well. . (See 15.4) This activity, and other considerations, lead to the supposition that since all properties imply other properties, we could go on analysing an adjective or other function words into more and more properties which belong to one another, until an arbitrary stopping point is made. Thus the kind of formalization given to any sentence would be dependent on this arbitrary point, and the predicate features of a formula would not have any necessary bearing upon the actual words of a sentence, with their specific semantic and syntactic organization.

The third definition involves the separation of non-exclusive from exclusive properties. But it will be

claimed that the one given is not valid, and consequently that the definition provides a pseudo-meaning analysis of an adjective, and not a syntactic description. Indeed, meaning concepts generally, could well be replaced by syntactic criteria in the differentiation of exclusiveness from non-exclusiveness.

A major claim in this chapter is that all three adjective definitions do not have valid differentiations and can be confused with one another. There is one qualification to this however. Reichenbach indicates that some adjectives can add +ly while others can not, and this could be made a central feature of definition.

Another important criticism is that, as on other occasions, he allows a formula of a given kind to represent more than one kind of English syntax expression, and curious invalidities and confusion result. Some incidental oddities, such as an instance of the construction of a private language, can also be noticed. (See 15.32) Some views about adverbs will come under notice as well.

But it is because of the major criticisms which have been made that it is felt the general system of definition of adjectives is of little value. Incomprehensible formulas make the calculus dependent on knowledge of original English sentences which might just as well have been retained.

15.02 At the end of this summary, and with previous work on functions, higher functions and arguments in mind, it may be useful to make some general comments upon their nature. In opening it will be fair to take a quotation from Reichenbach.

".... we do not wish to say that functions of a higher type are always clearly distinguishable from functions of the first type. The logistic interpretation of conversational language cannot be given without certain arbitrary restrictions of meaning. General predicates like colour and motion are not always used in strictly the same sense. Thus when we say red is a colour, we use colour as a second-type predicate; in the sentence a red thing is a coloured thing we use it as a first-type predicate." (E. pp.306-307.)

It should thus be said that criticism in 150I is to be related to Reichenbach's awareness of difficulties. Recognition should also be made of his awareness of the bearing of syntax upon the level of a function. But the reference to "arbitrary restrictions of meaning" is an instance of how he can be led away from giving the attention to syntax that is required.

The concepts of argument, function, and function-level are not syntactically basic in English. They are

meaning concepts which are flexible and not absolute in this application. Their meanings are not always sufficient to determine of themselves what sequences will, and what sequences will not satisfy them. For example note the problems which arise in 15.24 concerning adverbs.

Thus, if the distinction between function levels is difficult, and if argument and function words vary according to syntactic use, syntactic differences as well as meaning analyses must be made clear.

15.1 Formulas for Higher Functions.

15.11 One of the basic ideas is that predicates are open to narrower specification. Thus x moves does not specify speed, but the addition of the adverb slowly, (also called a modifier by Reichenbach) indicates more closely what the speed is.

"We may consider the individual motion of x, determined as to speed, direction, and so on, as a property f, which we call a specific property; the various properties f of this kind then may be included in a class of motion-properties represented by a function $\mu(f)$. The statement x_1 moves tells us that x_1 has one of the motion-properties; in symbols, with $m(x)$ for x moves:

$$\frac{m(x_1)}{df} = (\exists f) f(x_1) \cdot \mu(f) \quad \dots(1)".$$

(E. p.302.)

This means that the full definition of a function is given only when it is stated as one of a specific group of properties; f here, for example, is a special case of a group of motion-properties. The whole procedure can be considered redundant, because all that the original sentence says is that x has the property of movement. It does not specify any further, and so one may contrast with it the remark: "In class terminology, the class M co-ordinated to m is the disjunct of all the classes F co-ordinated to functions f having the property μ " (E. p.302.) That is,

$$\underline{M} = \frac{F_1 \vee F_2 \vee F_3 \vee \dots F_n}{df}$$

and the whole class μ has been sub-divided into classes of F

We seem to have complicated ourselves to no purpose. There appears to be no advantage in using this terminology over and above the simple f(x) form. What has really happened now is that a function has been split into a specific but unknown property f, which is given its specification of class membership at a higher level, e.g. by μ . So moves is treated in two parts instead of one which would be comparable with English syntax.

"We can now introduce the modifier slowly.

Writing msl(x) for x moves slowly and $\sigma(f)$ for f is slow, we obtain

$$\underline{msl(x_1)} = \frac{(\exists f)f(x_1) \cdot \mu(f) \cdot \sigma(f)}{df} \dots(2)."$$

It can be observed that the unnecessary complication forces us to retain the definition in order to stop msl(x₁) from confusing with other cases of f(x) where only functions of first type are involved, and where more than one letter may be used. (See E. p.426, solution 18:A:8).

Reichenbach holds that it is impossible to symbolize x₁ moves slowly as m(x₁) . σ(m), because slow does not apply to moving in general. So the specific property f must be introduced as in (2). (E. p.303, fn.I.) The argument however does not hold in view of E. p.214, where we have the pointer to formalizations like the following:

$$\begin{aligned} & \underline{(\exists m_1) . (\exists x_1) : m(x_1) . \sigma(m_1)} \\ \text{or} & \underline{(m) . (\exists x_1) : m(x_1) . \sigma(m)} \\ \text{or} & \underline{(m) . (\exists x_1) : m(x_1) . \sigma(m)} \end{aligned}$$

15.12 Before proceeding, a rather strange remark about (2) should be quoted:

"This analysis shows why adverbs can be constructed from adjectives by the addition of a suffix; they are predicates, like adjectives, not denoting properties of things, however, but of properties. The suffix ly indicates this usage." (E. p.303.)

A failure to understand the conventional nature of language is to be observed. Natural language forms could

neglect to construct adverbs from adjectives entirely.

Some of the theory of properties of properties is not at all fundamental, as we have previously claimed. In fact it has been seen that the terms zero argument, first type property, second type property, etc., are not absolute, but depend on syntactic information for their use. What is a property at one time may become an argument at another. This need not hold in a language at all.

15.2 Views on Exclusive and Non-Exclusive Properties.

15.21 Another point of criticism concerns the discussion of so-called mutually exclusive properties.

"The functions μ and σ used in (2) differ in one important point. The properties f comprehended in μ are mutually exclusive, i.e., if a thing, x_1 , has one of these properties, it cannot have one of the others. Thus if x_1 moves at 30 miles an hour, it cannot move simultaneously at 40 miles an hour. The properties f comprised in σ , however, are non-exclusive. Thus x_1 may move slowly and at the same time eat slowly or think slowly." (E. p.303.)

The separation of the properties into different classes is not valid. Consider that there are two non-exclusive motion-properties in Tom's movement was slow and graceful, and similar uses of two adjectives. Consider also Tom eats slowly, one piece at a time, where it cannot

also be said that to is eating two pieces at a time.

To say categorically that never is an exclusive property (or class of exclusive properties) while always is not, is to overlook the fact that exclusiveness or non-exclusiveness depends on what properties never, always, or any other property is said to have. For example, never is in relation to good must be exclusive, but in relation to eating or thinking it may be non-exclusive just as play is. For example, Sam never while he thinks, or for cats to be never. The categorical separation also ignores that if play were made a verb then it would also be subject to exclusiveness, e.g., if spread were introduced. That never may not become an adverb is incidental; when its verbal form is altered it may also be non-exclusive.

14.22 The exact definition in use of the kind of adjective illustrated by play will be dealt with next. It follows from Kolchbush's views just examined. But in order to understand what he does, it will be necessary to quote further.

Usually a first-type property \overline{P} , e.g., \overline{V} , is introduced in the form (1) only for higher functions to mutually exclusive properties, such as μ . If the higher function relates to non-exclusive properties, like the function α , the corresponding first-type property is usually defined by the requirement that

a great number of specific properties of \underline{x} , belong to \underline{d} , or that these specific properties of \underline{x}_1 which belong to a certain function \underline{K} are contained in \underline{d} . Here \underline{K} may mean, for instance, properties involving a change in time, or at least a group of relevant properties of this sort. The first-type property then is defined in the form

$$\frac{sl(x_1)}{dF} = \frac{\cancel{f}(f) [K(f) \cdot f(x_1) > d(f)]}{(E. p.303.)} \dots (3)."$$

So the adjective slow is defined as a non-exclusive property in the use \underline{x}_1 is slow represented by $sl(x_1)$. \underline{K} is of rather dubious redundant value. It seems to represent eats slowly, walks slowly, thinks slowly, etc. etc., that is, everything that can be modified by this particular specific property of slowness, \cancel{f} . Note also that the definition, as well as defining the adjective in this construction, gives an analysis of its semantic value according to Reichenbach's theories of meaning (e.g. exclusive or non-exclusive meaning with \underline{K} properties introduced or omitted). These scarcely seem a syntactic feature of English.

15.23 The definition also accepts the classificatory separation of exclusiveness (moves) and non-exclusive (slow) properties just attacked. If I say

- (1) (a) John sleeps (a) twice a day
- (b) while he eats
- (c) four times a day

only (a) and (c) are exclusive while (b) is not. Similar constructions could be made up for moves.

If I say: (2) John eats / while he sleeps

John talks / while he sleeps etc.

or John talks / sleepily

John walks / sleepily etc.

the adverbs or adverbial constructions after the verbs are probably always non-exclusive in such sentences.

Reichenbach has apparently hit upon the fact that any +ly word (not including those instances when ^{n+ly)}_{a+ly)} occur in positions of a+o) may occur in relation to a variety of verb forms, and has tried to show that this is part of the meaning of particular words, which may be classified apart from syntactic use, into exclusive and non-exclusive classes. But it is a syntactic characteristic of adverbs in general that they may modify a number of verbs, and so each is always non-exclusive in relation to the ones with which it can occur. But they may be exclusive in relation to other adverbs, - e.g., slowly excludes speedily.

We can consider too that adjectives carry the possibility of exclusiveness. Although x₁ is slow is treated by Reichenbach as containing a non-exclusive property, when slow is combined with other adjectives it could be treated as exclusive. For example, a thing which is slow cannot

at the same time be fast. The whole idea of exclusiveness and non-exclusiveness requires more thorough semantic and syntactic attention.

15.24 This is incidentally evident in a passage on the adverb. (E. pp.303-4.)

"Most adverbs represent functions d of the non-exclusive type. Thus adverbs like very, greatly, extremely, are of this sort. A man may have many specific properties to which the modifier very applies; he may be very intelligent, very strong, very helpful. Not always does language possess a word for the first-type property defined in (3). Thus we do not say x is very although this expression might be defined according to (3). Perhaps the term x₁ is outstanding may be conceived as derived from the adverb very by (3), when in this formula d is interpreted as very."

Firstly, the reason why very is ever to be considered in formalization as though it were a first type property is scarcely understandable. The paragraph suggests that all second type properties could be formalized as first type ones, and thus the different positional or syntactic characteristics of the word-classes involved could be obscured. But it is impossible to know how the

theory could be applied systematically. In any case, if any adjective (e.g. outstanding) similar in meaning to an adverb, (e.g. very) can be derived from that adverb and then defined through the adverb, then we have a semantic analysis, which has no relation whatever to syntax. A great deal of confusion in the interpretation of formulas could once more result.

A couple more passages on the traditional adverb show arbitrary analysis as well. (See E. p.308.) In one it is claimed that some "adverbs" which refer to time and space should not be so-called because they really provide arguments. However, it appears to be only a matter of accepted convention that such values of a+ly and words like now, then, etc., are not made functions in the usual manner. For special synthetic values of natural language distributional classes are picked out, and given separate formalization in the calculus. Other values could be treated in a similar manner.

In a second passage Reichenbach argues that a+ly words and others which appear after the verb provide numerical qualification. They should be considered not second level functions but first, because they concern the occurrence of objects or events. This however appears difficult to prove. Consider Tom seldom works.

A justification which he makes for his treatment of

space, time and numerical specifications is that these adverbs modify sentences as a whole. This does not really appear any more true or false than for adverbs in general. Consider now, then and after in Tom works now, Tom worked then, and Tom will work after he leaves us.

In all, there is illustration again of the use of both synthetic and syntactic material in the definitions of symbols.

15.3 Second Definition of the Adjective.

15.31 We are asked to take a statement containing two independent properties, such as Royce Hall is a red building. (See E. p.304.)

$$\underline{bl(x_1) \cdot r(x_1)} \quad \dots (4).$$

As before, each property can be said to include a number of specific properties; a building can have many shapes and sizes, and red has many shades. So it is said that the properties in this sentence can be treated as first-type specific ones derived from second-type ones. The second definition of an adjective results.

$$\begin{aligned} \underline{bl(x_1) = (\exists f)f(x_1) \cdot \lambda(f)} \\ \text{df} \\ \underline{r(x_1) = (\exists f)f(x_1) \cdot \rho(f)} \\ \text{df} \end{aligned} \quad \dots (5).$$

The "class of specific sorts of buildings" is expressed by λ and "the class of shades of red" by ρ (5) replaces (4) to give

$$\frac{[(\exists x)(\exists z_1) \cdot \lambda(x)] \cdot [(\exists x)(\exists z_1) \cdot \rho(x)]}{\dots (1)} \quad (1)$$

(1) since it is evident that the possible breakdown causes λ to act not as a variable, but as a constant, a term denoting specific property, whose possible range of values is given by the higher function combined with it. Now since the breakdown need not always occur, how are interpreters to know when the λ of (1) stands for a variable and when it stands for the constant? Compare the use of λ in

$$\lambda[\lambda(z_1) = \rho(x)] \quad (\text{where } \lambda \text{ has only useful properties}) \quad (2, p. 216.)$$

16.32 In continuation of the study of adjectives and adverbs it is said that (2) compared with (1) shows the "identity of specific properties expressed by the adverbial suffix ly" while (1) does not. (1. p. 206.) A term like (1) is said to be derivable from (2) but it will not correspond to z_1 nouns and z_1 is adv., and there will be no corresponding conversational rule for the first type property in the second context. (1. p. 204-5.)

This practice invites criticism in that a privately constructed language is not useful for representation of English. In addition, since an ordinary conversational adjective is to be formalized in the same way exactly, there is no room of differentiating it from this non-ordinary kind when the formulas are imposed. The non-

adjectives that should be given a different classification.

15.18 Another in certain problem arises from the view that the definition of an adjective like glaz in (1) is to be only one of the definitions of an adjective like glaz in (2). (C. 1.1.1.) For we are to recognize when (3) is to be used and when it is not? Are we to rely on the distinction between exclusive and non-exclusive adjectives? If so, the criterion for it have not been given clearly at all; we cannot even consider that an adjective like glaz is always non-exclusive. (The only way of representing glaz and glaz would be to insist that one can be turned into an adverb but that the other cannot. But this would be a purely syntactic differentiation and would not fit of problems raised in 14.19.)

15.4 Definition of the adjective.

There is still a third definition of the adjective to be considered; "... the derivation of the adjective glaz is a corresponding function of the second type" is represented in a more different form the previous cases of glaz and glaz. (C. 1.1.1. 1.1.1.)

So we to consider a series of sentences and words for illustration. In the same function is represented by

(1) glaz (1.1.1. 1.1.1.) ... (2)

8 represents the function derivative of properties of

dancing, and β the function consisting of properties of beauty. Annette dances, with a first-type predicate, is definable as

$$\frac{d(x_1) = (\exists f)f(x_1) \cdot \delta(f)}{df} \quad \dots(9)$$

(Formula (8) is the same as formula (2). (8) omits a dot after $f(x_1)$ in the original, but this seems to be a printing error, for Reichenbach also considers them the same. (See 15.6). (9) is the same as (1).)

But beautiful, as another first-type predicate in Annette is beautiful is not definable in the way of (9). Here, it is said, beautiful modifies a particular property of Annette, her bodily form. So it is defined in

$$\frac{bt(x_1) = (\exists f)f(x_1) \cdot \alpha(f) \cdot \beta(f)}{df} \quad \dots(10)$$

" α is the function comprehending all individual forms of human bodies such that each f belonging to it specifies the shape of the whole body." ((10) is the same as (8) and (2).)

This interpretation of the meaning of beautiful (with which we are not agreed) leads to the question why red could not receive the same treatment and be defined in the same way. Reichenbach's remarks could be copied in order to say "When we say x is red we mean that a particular property of x , namely, its bodily form, is red". It is possible to conceive all adjectives to be like beautiful and define them by (10).

The remarks concerning α , and other comments in previous sections, also give rise to another major criticism. They suggest that we could go on analysing the meanings of adjectives into properties which belong to other properties which belong to other properties without any explicit end. Thus the kind of formalization given to any sentence depends on what semantic stopping point is arbitrarily chosen, and the predicate features of a formula do not have any necessary bearing upon what actually occurs semantically in any sentence, nor upon what structure the sentence has.

15.5 Summary.

15.5. In summary, the three classes of adjectives as given by (3), (5) and (10) are invalid. In (10) there is a meaning analysis which could apply in (3) and (5) as well, and in (3) and (5) there is no reason for supposing that adjectives such as slow and red are necessarily different, nor that the distinction between exclusiveness and non-exclusiveness is useful. It is to be wondered whether Reichenbach would consider red to be a non-exclusive adjective like slow, if it could be used as an adverb. If so, then it is this syntactic feature which must be used to define the difference between the two classes.

15.6 Other Problems.

15.61. Other problems arise with formulas which are the same but which give rise to different kinds of sentences.

(a) (10) for example corresponds to (2): "it can be read in the form Annette is beautifully shaped."

(E. p.305.) Consequently the one formula can be read (t)n is a, (t)n v a+ly or (t)n is a+ly v+d. (Absence of inflection notation indicates general reference to nouns and verbs.) As a result, nonsense could be generated when we try to interpret the formula. For The dog is furry we could write instead The dog v+s furrily or The dog furries a+ly. The one formula consequently allows a sentence like the first to be held equivalent in meaning to either of the other two. This is incorrect, as maintained in 15.4 concerning Annette is beautiful.

(b) The one type of formula given in (1), (5) and (9), (also (7), E. p.304), represents (t) n v, (t) n is a and ... is a n. It is difficult to understand why a full finite verb construction is formalized in the same way as a noun expansion. Once more, nonsense could be generated in interpretation.

(c) "This analysis $\llbracket(10)\rrbracket$ explains why, although expressions like (2) and (8) are symmetrical in the two functions of higher order, verb and adverb do

not occupy symmetrical positions in conversational language. Only if ^{we} were to use a definition of the adjective beautiful corresponding to (9), namely, in the form

$$\frac{bt(x_1) = (\exists f) f(x_1) \cdot \beta(f)}{df} \quad \dots (11)$$

could we give to (8) a symmetrical interpretation; namely, we then could read (8) also in the form

Annette is beautiful dancingly. But although such a terminology might not appear incorrect, it certainly does not correspond to actual usage." (E. p.306.)

Reichenbach seems to be indicating here that if a definition of the kind given in (1), (5), (7), (9) and (11) were also used for x_1 is beautiful, the a+o v+ing+ly replacement could be allowed for β and δ in (8). The definition of the adjective in (10), corresponding to its adverbial form in (8), prevents this.

But since definition (5) or (9) is valid for a number of adjectives, if such an adjective were found to have a corresponding adverbial form as in (8), then the replacement would be possible. Take x_1 is soft formalized as in (5) or (9). Take x_1 talks softly formalized as in (8). Then as Reichenbach has pointed out, (9) can be used to interpret part of (8), and we can generate the invalid sentence x_1 is soft talkingly.

(d) A final criticism is that while an attempt is made to prevent Annette is beautiful dancingly from resulting in (8), since Annette is beautifully shaped is allowed by (10), and (10) corresponds to (8), this last is permitted by (8) also. So from mere inspection of ⁽⁸⁾Annette is beautifully danced could result. In fact then, the formula's value is only known when we first know what sentence it is formalizing. Similar considerations apply to (10). Since (8) can be interpreted by n v a+ly so also can (10), and we could get Annette beautifies shapefully.

15.62 That the formulas are only clear when the individual sentences which they represent are first known makes the calculus non-formal. A user might just as well read the sentences in their original state.

The system of definitions for adjectives may justifiably be scrapped, but non-formality will nevertheless remain as a general charge against the calculus as a whole.

The line of thought suggested by Reichenbach in opposing those adjectives which take +ly and those which do not (see 14.11), is considerably more valuable than his conceptual intricacies about function level in formalization, and could lead to precise syntactic divisions.

CHAPTER 16.

DESCRIPTIONAL FUNCTIONS.

16.0 Introduction.

The redundancy of formalization in descriptonal functions, and the unacceptable distinction between heterogeneous and homogeneous ones, are of sufficient importance to require comment. Nevertheless, the practice of extending the use of descriptonal functions beyond strict limits creates the more serious concern.

The process of solving in particular is dangerous. It involves turning certain noun sequences into verb sequences which have the same referential meaning, and can be criticized in three ways. Firstly, since the noun need not include the verb base the necessity for a syntactic relationship between the two sentences is not required. (Cp. 22.2) Secondly, the process shows that both the verb and the noun sequences can be formalized by means of descriptonal functions. Thirdly, since many verb and noun sequences could be submitted to solving, the use of descriptonal functions is greatly widened.

Confusion is created in (a) English interpretation of the solving formulas, for they can represent a full or a partial sentence, and in (b) choice of formula for any given English sentence. With regard to (b), an English

sentence might now be formalized in event-style, complex-function style, descriptive function style, or in one of the modes of 15.11. Questions of formalization also arise in descriptive functions drawn from other sequences which have equivalences of a finite verbal nature. But these have already been discussed in 13.33 and reference only is made to them.

A vital question arises from recognition of a more incidental feature, the use of descriptive functions in cases of the superlative adjective. It concerns the real nature of Reichenbach's work on English. (See also 13.13.)

For example, it appears that the concept of function begins as a meaning concept for him, but is used in so many diverse ways that it can be extracted from almost any sequence. Now some convenient examples of the formalization of comparative and superlative uses of the adjective, show that not only do such meta-language concepts occur in a formula, but that object-language elements do so too. This means there is an attempt to re-express the information of the object-language in a new grammar. This constitutes translation.

Two points are to be made. One : since Reichenbach maintains that logical grammar provides a preferable means of studying English structure, then one could equally maintain that French grammar also provides a means of

studying the structure of English. Second : the grammatical elements of the logical language such as function, however, do not exist in their own right as French ones do, for the supposedly informative expressions in which they occur are incomprehensible without knowledge of English grammar and vocabulary.

16.1 Nature of a Descriptive Function.

16.11 A descriptive function formula really provides just another way of formalizing the word sequence called a description. When the descriptive function is used properly, that is, when it determines one unique individual from a range, it is to be called a functor. Thus the father of is a descriptive function in the sequence the father of x_1 . The individual so determined may be called y_1 and so we have the general formula

$$\underline{y_1 = f'(x_1)}$$

where f' symbolizes a descriptive function. Now this equation can be written in the form of a proposition, $f(y_1, x_1)$. So when a word sequence occurs which states that an individual equals its description as in John is the father of Tom, any of several modes of formalization is possible.

$$(a) \quad \underline{y_1 = f'(x_1)}$$

$$(b) \quad \underline{f(y_1, x_1)}$$

$$(c) \quad \underline{y_2 = (xy)(y) \cdot y(y, y)}$$

$$(d) \quad \underline{(y) \cdot y(y)} \text{ where } y \text{ is a constant}$$

symbol for a complex function, in the father of y_2 , and its definition would have to be given. (The form y_2 also could also be used).

The redundancy would be independent except for causing unnecessary complication, if it were not for the knowledge that instances of $f(x)$ and $f(x, y, \dots, z)$ allow multiple constant type interpretations. (Each form y_2 and (c) should have been kept for unique statements

10.22 "The descriptive functions as far as considered determine concepts of the same type as their arguments and may be called heterogeneous. There is a second kind of descriptive function which determines a predicate in terms of an argument of this predicate; such descriptive functions will be called heterogeneous." (p. 313.)

For example, the concept of this paper is denoted $f''(x)$ and is to be defined by the general formula

$$f''(x) = \frac{d}{dx} (22)f(x) \cdot y(x) \quad (p. 313.)$$

The two elements f and y are of the individual type and f is of a higher type than y and thus it is the same type as x . (p. 313.)

However, in order to avoid any confusion also

define the father of x_1 , i.e. $f'(x_1)$ as $df(\lambda f)(x) . y(f)$. The introduction of father properties over and above father would be just as legitimate as the introduction of colour properties over and above colour. The use of higher functions at some times and not at others remains equally unexplained in the solutions to exercises. (E. p.425 foll.)

16.2 Extension of Use of Descriptive Functions.

16.21 Reichenbach does not confine the use of descriptive functions to morpheme sequences of the kind above. A vulnerable extension is due to the process of solving. The sentence x_1 moves at 50 miles an hour is solved in the form

$$\lambda f) f(x_1) . \mu(f) = 50 \quad \dots (1)$$

and the contraction of it, $f''(x_1) = 50$ is held to mean the speed of x_1 equals 50. (See E. pp. 311, 314.)

It follows that descriptive notation can be introduced, when the referential meaning of one sentence with a numerical assessment of the verb information, can be put into another, where the verb meaning of the original sentence is expressed in noun form. Since it is not necessary for the noun to use the verb base, a syntactic relationship between the two sentences is not required.

Reichenbach goes on to say that numerical functors of the heterogeneous kind are common in the natural sciences,

and simply lists the isolated words velocity, temperature, pressure and weight as examples. This suggests that both the noun sentence and the verb sentence can be formalized with descriptonal notation, and indeed, the process of solving makes the practice quite evident. Since many nouns other than the ones cited can express verbal meanings, and since many verbs can be given numerical assessment, the numbers of verb sentences which can be solved, and the numbers of noun sentences which can be treated as solutions, are great.

In addition there is no reason for believing that sentences with no numerical assessment of the verb information cannot receive the same treatment. (See E. p.316 on non-numerical functors.) Indeed, Reichenbach goes even further in saying that "Descriptonal functions determining arguments can be constructed from every propositional function which can be made univocal with respect to one argument." (E. p.317.)

So the two questions of what formula to use for a given sentence, and of what interpretation to use for a given formula, here become unanswerable. For example, Tom runs slowly can be formalized in the event manner, or as a form with a complex function, in the descriptonal function manner, or as one of the forms of 15.11. Again, various sentences using nouns such as velocity, speed, pressure,

or earthquake can be treated, e.g., in either event or descriptonal function form. Nor can we know whether the formula $f''(x_1) = \text{no.}$ stands for a full sentence or for a partial sentence such as the speed of x_1 at 50 miles an hour, even when a definition is supplied by (1). (1) can be interpreted in a variety of ways.

It does not appear convenient to use the formulas at all if they are interchangeable for different natural language sentence or partial sentence forms. (For further problems of formalization relating to descriptonal functions drawn from sequences which have verb sequence equivalences, see 13.33.)

16.22 In Reichenbach's treatment of comparative adjectives the question of descriptonal functions does not arise except in the case of the superlative, which is said to provide a comparative description as in the tallest man.

The discussion does however lead to a criticism which links with 13.13. We are to formalize (a) Peter is as tall as Paul by saying

"we assume that all specific properties of tallness can be ordered in a linear series, and then assert that the specific tallness is the same for both Peter and Paul. In symbols, with τ for tall,

$$\underline{(\exists f)(\exists g)f(x_1) \cdot g(y_1) \cdot \tau(f) \cdot \tau(g) \cdot (f=g) \dots (18)''}$$

(b) Peter is taller than Paul is treated in a similar way and given another comparable "form". (18) can be considered a definition of the two-place relation as tall as, in the form ats(x_1 , y_1). Similarly tlr(x_1 , y_1) represents (b). (See E. pp.315-316.)

Now what exactly does (18) formalize? If it is the "form" of all sentences of the kind \bar{n} is as a+o as \bar{n} , then why should the property tall of the object language be retained? (18) could only be called an expression of the basic structural meaning of the sentence if it applied to all sentences of this kind. τ would then have to be not a symbol for a specified adjective, but a symbol representing the adjective class. Criticisms of the same kind apply to the shorter expressions which use ats and tlr. If we are interested in form, then why should the functions be based partly on tall as a semantic element as well as on features which always denote a comparison and which are syntactic?

It is extremely important to notice that Reichenbach has not made clear exactly what he is trying to do here or in any other formula. (Compare E. p.253 where he treats the converse of the two place function taller.) Object-language (i.e. semantic) elements are retained in the meta-language along with the meta-language elements, such as function and argument. Thus a logical formula

merely becomes an attempt to re-express the information of the object-language in a different kind of grammar (and vocabulary, since t e.g. now stands for tall). Such a translation could be satisfactory if the new grammar and vocabulary were adequate and distinct, and the translator understood the exact nature of his activity.

CHAPTER 17.

LOGICAL TERMS.

17.0 Introduction.

17.01 Discussion of the correlation of calculus symbols to features of English has so far centred on the two kinds of variables, arguments and functions. Now logical terms or constants will complete it.

The following study must be understood in the light of Reichenbach's statement that much work remains to be done upon them. In particular, he says that pragmatic logical terms need special attention.

However, it can firstly be said that his basic definition of a logical term is of considerable interest and value. He shows that logical terms cannot occur as values of a variable, and in study of syntactic aspects helps considerably towards disposing of ambiguity in their definition. (Thus views in the present paper can be seen to link with some of his.)

Unfortunately however, he allows himself to become misled by meaning considerations which cause confusion. These will receive a fair amount of attention. For example the attempt to separate logical constants from values of a variable by way of meaning concepts can be seen to fail.

A second important point is that his work is made

needlessly obscure through uses of the terms, denotative and logical. These have to be sorted out before meaning problems can be adequately handled.

His discussion of the difficulty of treating some words either as denotative (i.e. not logical) or expressive (i.e. logical), while it does not provide a solution, invites interest. It leads to linking expressive terms with our logical constants, and to showing that a denotative value can be linked with a semantic one. Therefore a denotative value cannot of itself cause a word to be called a denotative term, for we hold that a denotative value must occur in any logical term.

Again, consider the case of a value of a variable which causes Reichenbach to hesitate over classification because he finds there both denotative and expressive elements. The word he takes is see. Since we hold it is a term of the object language, being in fact a value of a distributional class, it therefore must display the syntactic (or expressive) features of the class as well as individual semantic (or denotative) content. But it can not be called a logical term because this is a term of the meta-language which denotes the whole class with its positional characteristics.

These ideas lead on to a justification of our separation of syntactic meaning from semantic. A semantic

term is never to be confused with a syntactic one, but a semantic meaning is never expressed without a syntactic one. Thus we find it preferable to use Carnap's expression autonomous¹ to describe both the object language and meta-language nature of a logical constant.

17.02 The meaning division of logical terms into syntactical, semantical and pragmatic which Reichenbach makes, causes serious doubts. It necessarily includes the denial of the validity of our definition of a logical constant. Nevertheless it is hoped that the general application of our definition and views about syntax will be of some value. (Here, syntactic is not identical with syntactical nor semantic with semantical.)

Reichenbach says for instance that it is a matter for open discussion whether syntactical and semantical terms should be differentiated, and that pragmatic terms need attention. His extraneous logical terms which do not belong to any of the three divisions also appear to need clarification.

It will be held here that syntactical and semantical terms are the same because examples of each are needed in tautologies and because both have exactly the same nature in a syntactic meta-language. The meaning definition of a semantical logical term is also hard to separate from a pragmatic one.

The important question of whether the whole field of pragmatics can be separated from that of semantics also arises. But whatever the case it will be argued that pragmatics has little value in English syntax study. The structure of the usually accepted pragmatic sentences can be expressed in the usual English syntax notation. Words like believe can be discussed better in semantic studies which may be introduced into the syntax system. Other questions about pragmatic terms also arise when Reichenbach appears to use meaning analysis in an arbitrary manner.

We would prefer to replace such meaning distinctions as pragmatic and semantical in syntax study by statements of different kinds of metalanguage symbol order. Thus statements, commands and questions would be of interest for they each have distinct characteristics. In meaning study, we would also prefer to replace the same two concepts by those of emotive and referential meaning. It is possible to treat pragmatic as a term in the study of emotive values of words, and semantical as a term in the study of referential values.

However, a calculus of pragmatics for example could still be created (though it would seem better to replace pragmatics by another word) by considering a sub-class of the values of structural elements. A logic of commands could also be created by considering only a sub-class of

the structural elements themselves.

17.03 An appendix on basic sentence types has been added to this last chapter for purposes of comparison with the appendices elsewhere.

17.1 Reichenbach on Logical Terms.

17.11 First of all, it is held that logical terms are to be distinguished from denotative terms, which are any of the values of an argument, functional or propositional variable. A logical term is said to be expressive, which means that it is not used as a denotative term, and it is also said to be indispensable. It is added that some denotative terms may be defined by expressive and indispensable terms and so are really logical terms.
(E. p.319 foll.)

A most important and valuable part of these theories is that an expressive term cannot rightfully occur as a value of a variable. There is a definite advance here in understanding the nature of constants. But Reichenbach becomes side-tracked into trying unsuccessfully to separate expressive from denotative terms on a meaning basis. For example, there is no substantial reason given (E. p.320.) why the copula is, or the brackets which in symbolic logic translate is, should merely portray or express a relation between variables, whereas the word loves in John loves

is, should denote a relation.

17.12. We can now start to examine what is meant by indispensable. (E. p.320 foll.) We begin by noting that it is said that a denotative term may be used for an expressive one. This actually means that a name for an expressive sign may be introduced at a higher level of language, that is, in a metalanguage. If the definition of this name demands that the expressive term itself must be used as part of the definition, then the expressive term is indispensable and the denotative term is considered logical. (Such denotative terms may be introduced as contractions for any logical terms, E.g., see the use of un for the all-operator. E. p.324.)

This test, leading directly in to the definition of a logical term (E. p.323), may or may not be of considerable value. But when we see that in a definition of the expressive term is, we are allowed to call has the expressive term corresponding to is, because it is necessary in a definition giving the denotative term for is, it seems that we may extend the term expressive rather arbitrarily to any word we like to introduce into a definition. Consequently we may or may not call many terms indispensable. (See E. pp.321-2.)

17.13 Further calls upon meaning do not resolve difficulties. For example, E. p.322 is of no assistance

because it allies expressive terms with meaning connotations of words which are values of variables, and overlooks the fact that an expressive logical term must have formal distributional features which are different from those of values of variables, if it is to be separated from them.

That a logical term is merely connotative or expressive and does not denote is not acceptable. It denotes if only through its formal meaning value. However, what Reichenbach fully means by denotation is not really clear.

17.14 Reichenbach's reference to the impossibility of separating the idea of denotative from expressive in some terms is of interest (E. p.322). Here he attempts to show that some words like see cannot be classified either as denotative or expressive because they unite both concepts. He holds that because see in I see the tower has no suffix, that is, exhibits no expressive logical sign, we tend to think of it as denotative. But, he says, its logical character is nevertheless evident in the fact that it belongs to a class of words which are used for tense reference.

We would say in our turn that the syntactic character of the semantic value see is indicated by the fact that it occurs in the same position of a sentence as

a class of other semantic values. (The occurrence or non-occurrence of a suffix is incidental.) We can consequently find a similarity between logical expressive and syntactic, and another between denotative and semantic.

We would thus follow Reichenbach in holding that the order of the arrangements of classes is a logical feature of a language, just as certain individual words called logical constants are logical features. (See E. p. 322.)

But we would also hold that the idea of see as both denotative and logical, i.e. both syntactic and semantic, is misleading. It is quite true that any value of a variable cannot occur without displaying syntactic features, but it cannot be called a term of the syntax language. See is an object language term whose membership in a syntactic variable is made clear by characteristics of positional use. Reichenbach calls this syntactic variable a function while we call it a verb.

The necessity not to confuse syntactic terms with semantic ones links with the problem of whether it is legitimate to separate syntactic meaning from semantic. While it is evident that no value of a variable (or no logical constant) can occur without both syntactic and semantic features, it is also evident that in any class, all the meanings of its individual values may be dis-

regarded in order to state what meaning or meanings are common to the class. This justifies the term syntactic meaning.

It appears that Reichenbach should have shown that a semantic term is never to be confused with a syntactic one, but that a semantic meaning is never expressed without a syntactic one. (Even for members of classes like n/a a limitation upon what syntactic meanings occur in these words is a necessary part of them.)

17.15 It is not until he attempts to deal with syntactic aspects of indispensability in logical terms that we get nearer to an adequate definition of them, (E. p.324) Here he shows that a logical term is irreplaceable in a tautology (that is, it cannot be replaced for the sentence to remain true without empirical investigation). We note that in contrast, values of variables may be replaced by other values and the tautology will remain. (See E.pp.323-325 and E. p.130. Note also 17.31 below.)

Although this theory is not completely acceptable, because we hold that a logical term is one which is necessary in a sentence, and not only in tautologies, it makes a large advance. As Reichenbach and Carnap have recognized, ambiguity in definition has been common. (See E. p.323.)

Reichenbach himself holds that his own definition is not fully adequate, the word indispensable being interpretable in different ways, depending on the purpose of a language.

It is hoped that the definition given in this paper will show how an indispensable term in one language need not be so in another. (See 7.4, 3.32.)

17.2 Syntactical Logical Terms.

17.21 The logical terms are divided in the book into syntactical, semantical and pragmatic. Syntactical ones express a relation between variables; semantical ones concern the truth range of a statement; pragmatic ones have an instrumental nature. The distinction between syntactical and semantical denies the validity of the definition we have made of logical terms. But if this definition is of value, it in turn makes the distinction illustrate the need for clearer conceptualization of what a logical term is. In the following discussion it is to be noted that syntactical and semantical are not equivalent to our terms syntactic and semantic.

17.22 The syntactical logical terms are divided into sub-classes. The first refers to arguments. Here, "we first find terms indicating the place of the variable, including inflections of nouns, and prepositions. Prepositions usually not only have

this logical function, but also take over a part of the meaning of the statement; thus it lies on the table and it lies under the table differ as to the space indication." (E. p.325.)

Firstly, it is not pointed out that "the place of the variable" is not indicated by any particular inflection or term alone, but by the position of the inflection or term in relation to the variable. That is, morpheme order, where morphemes may be either bound or free, is of prime importance. For example, on supplies no idea of the position of the variable unless it occurs in the way it does above. (Prepositions may also be considered as showing the place of functions.)

Secondly in and under do both occur in the same position here, but do they satisfy Reichenbach's definition of an indispensable expressive term? In order to say whether they satisfy our definition of a logical term we would have to gain further empiric knowledge in order to see whether they each had unique distributional characteristics. Reichenbach appears to hint at such problems when he says that some prepositions should be treated like the adverbs as functions of higher type, that is, as values of a class variable. (E. p.325.)

17.23 The second sub-class comprises terms representing variables.

"They are expressive terms according to our definition, because only special values of variables denote. In conversational language variables are represented by pronouns. They include the personal pronouns he, she, it, ... relative pronouns and possessive pronouns." (E. p.326.)

It is not agreed that the personal, relative, and possessive pronouns, are logical terms standing for variables. Their use in English is as symbols for special values of variables, and none has any informative value unless the special value for which it substitutes is known. If they were terms representing variables, then any value of an argument could be put in their place, and the resulting form would still convey information. This is not true. In contrast, the symbols x and f naming the argument and function variables are logical terms.

17.24 This last section leads to a general criticism of the whole unit on logical terms, for the uses of logical or expressive and denotative are not always consistent. It is a disadvantage that denotative has been used to describe a value of a variable in the object language, and the metalanguage name of a logical constant as well. With respect to this last, see where un is called the denotative term for the all-operator of the object language. (E. p.324.)

The following definitions may be supplied:

(1) When an expressive indispensable term, called a logical term, is an individual term, it occurs as an individual term in the object language.

(2) A value of a variable always occurs in the object language. It is called denotative.

(1) and (2) constitute all the symbols of the object language.

But (a): A denotative term for (1), i.e. a name for (1), may occur in the metalanguage. (E. pp.320, 323.)

(b): A name for a variable may also occur in the metalanguage, but this name is called expressive. (E. pp.325-6.)

The result is rather confusing as it allows (1) and (b) to be mixed up together so that we do not know whether the language under discussion is object language or metalanguage. Reichenbach also has a tendency to call members of (2) expressive terms, thus confusing them with (b).

(See E. p.322.)

17.25 The third sub-class refers to functions.

"Here we have terms expressing the converse of a function, as the passive voice; furthermore terms expressing functional modifiers such as the suffix ly and the term in such a way." (E. p.326.)

As a result of preceding theory exception is taken to the inclusion of in such a way. Its true character is

a meaning description of formal syntactic features such as ly, but it is not in itself a logical term in our sense.

The remaining two sub-classes consist of (4) terms referring to argument and function, and (5) punctuation. (E. p.326.)

Neither of these groups offers any particular theoretical development, except that in (4) it is said: "If the indefinite article is used without the copula, it belongs among semantical terms, since it indicates an existential operator." (E. p.326.) This is not always so, as many sentences occur which are like The sea-serpents are large (fictitious existence) and The whale is a mammal (universal operator).

17.3 Logical Terms in a Semantical Capacity.

17.31 Reichenbach states that it is a matter for open discussion whether they should be separated from syntactical logical terms. Preceding theory suggests that they should not and some further reasons for holding this view will be presented.

The first sub-class consists of the propositional operations.

We regard these operations as semantical because of their definition by means of the truth tables, which confers on them a truth-functional character.

The semantical nature of the propositional operations

is also evident from the fact that we can construct true formulas which contain only variables and propositional operations." (E. p.327.)

But may we not claim equally a characteristic of semantical truth for the syntactic terms? For example, It is on the table could be defined equivalent to It is not P_1 the table, It is P_1 the table, It is not P_n the table, if it is hold that on is a logical term. Thus a truth table could be constructed.

A strong claim could also be made for considering the syntactical terms referring to argument and function (e.g., is a) as semantic, because they also express a truth value. For terms for variables, we may also see that a semantical truth value enters when we try to replace one logical symbol for a variable, by another logical symbol for a variable: in any true formula this sort of substitution cannot be permitted.

Apart from these examples, we have seen that Reichenbach's own views lead us to develop the idea that any logical term (including any syntactical one) is a term that cannot be replaced by another logical term if we want an expression to remain true, independent of further empiric knowledge. A denotative or object language term on the other hand may be replaced by another, and the expression will still be tautological.

Concerning the propositional operations, Reichenbach says that they are expressive (i.e. logical) and not denotative because

"It is clear that when we write a tautology in a form that uses the propositional operations as functional constants [e.g., $\text{or}(a,b)$] it is not permissible to replace these constants by functional variables since the formula would become false." (E. p.328.)

We maintain that syntactical and semantical logical terms are the same because examples of both are needed in tautologies, and because both have exactly the same nature in a syntactic metalanguage. This last follows from the theories given in 17.2 as well as in 7.4 and 4.3.

17.32 Because of our general theory we disagree with Reichenbach below. He goes on to consider some conjunctions and verbs like imply and mean, and also the adjective equivalent, to be propositional operations. Imply is to be considered a denotative term in the metalanguage for the logical expressive term if then, because it is definable in terms of if then. (E. p.329)

Now the judgment as to the nature of terms in an object language is dependent upon the structure of that language itself, no matter whether it is natural or artificial. It may be seen that the words imply, mean,

and equivalent in the structure of English may all be replaced by other words in order to form sentences. For example, in That Z that Z where the symbol Z stands for any sentence, the blank may be filled by warns, hints, suggests, permits, allows, means, implies, forbids, prevents, etc. Also, for example in Z and Z is/are _____, the blank may be filled by true, equivalent, contradictory, similar, strange, false, necessary, possible, likely, familiar, expected, desired, etc.

While a full study has certainly not been undertaken of all sentence rules, unless these verbs, and the adjective equivalent, behave differently from other verbs and adjectives in the structure of English they must be considered as object values of the logical variable signs standing for all verbs and adjectives.

This does not deny that they may be held as constants in a deductive calculus developed from the syntax of English and it may be more useful to do so for certain purposes. But their use as constants must be distinguished from the occurrence of any true logical constants in the language. It is a mistaken tendency of logicians to consider all the English word interpretations of their so-called logical symbols as constants.

17.33 The second subdivision consists of the operators all, some, there and is, because they can be

considered extensions of the conjunction and disjunction operations. The iota-operator is also included, and thus leads to calling the and a semantical logical terms as well. (E. pp.330-1.)

The previous objections to this distinction between semantical and syntactical also apply here. The statement that the plural suffix is a semantical logical term because "it expresses that there is more than one satisfying argument" is particularly unsatisfactory.

Again, we see that Reichenbach's justification for calling certain English words logical, is based on a study of these words as interpretations of symbols occurring in an artificial language whose structure is different from that of English. If we hold the and a as logical constants it will be for reasons different from those given.

17-34 The third subdivision consists of denotative semantical terms, "i.e., terms which denote and by logical analysis are shown to be reducible to expressive semantical terms." (E. p.331.)

Some of these terms merely illustrate possibilities for further criticism along previous lines, but it may be pointed out that the individual terms property and physical object may be better treated as universal words (defined by Carnap) in relation to the symbols of Reichenbach's language.² While they provide the meanings of logical

symbols here, they need not be considered universal words in relation to English, unless it is found that there are logical terms in English which always carry these meanings.

A final point in this section arises from a discussion of four different meanings of is: "first, it means the relation of class membership; second, it means the relation of class inclusion; third, it means existence as in the phrase there is; fourth, it means identity." (E. pp.334-5.)

But the exact syntactic clues which tell us which meaning is to be correlated with which form, are inadequately given. How to analyse a given text by its formal structure is not clear, and we are required to depend on intuition. This is clearly the result of considering the structure of the language to be based on so-called logical norms. Jespersen provides a more complete account of the uses of is.³

The fourth subdivision concerns "sign denominative symbols" and is of little interest here.

17.4 Logical Terms in a Pragmatic Capacity.

17.41 We find it difficult to separate pragmatics from semantics, and we are consequently doubtful of the usefulness of setting up this third category of logical terms. For example, when it is said pragmatics

"adds a reference to persons; it therefore refers to things, signs and persons. Of this kind is the statement: I consider this sentence true or this sentence is a law of physics, as the latter proposition states that physicists consider the sentence true." (E. pp.15-16),

we believe this holds for any semantic statement, since somebody believes it true, or somebody believes it false, or neither. In any case, pragmatics has little value in the study of English syntax, as the structure of sentences like I believe that John is here (often considered pragmatic), can be stated solely in terms of the constants and word classes of English. Words like believe more properly enter semantic analyses which may be introduced into the syntactic system.

17.42 It is claimed by Reichenbach that pragmatic logical terms, by making sign combinations instruments of a speaker, and therefore by doing this and not saying it, are expressive. They are also indispensable as there is no other means of making such instruments. Denotative terms cannot do so, because they are in the cognitive field, and so cannot change an expression into a non-cognitive one. (E. p.336) The assertion signs, that is yes and no and the period, are then given as members of the first sub-class of pragmatic signs.

We find it impossible to accept the line of thought here, and can see no great difference in English between the period sign and any other logical constant such as +s plural in a sentence of the form $n_1 + s$ are $a + o$. Both are equally necessary in order to have a sentence of this symbol arrangement at all, and therefore in order to make it an "instrument of a speaker".

The full stop in written language is surely a clear cut sign taking the place of intonation in spoken language. It may be dispensable in certain symbol arrangements, and replaced by a comma or etc., but it is a mark of a sentence arrangement wherever it occurs. (Cp. 2.13.) So also is the +s plural where it is indispensable.

17.43 The statement that the period and all assertion signs are pragmatic leads to contradictions below.

The analysis of the assertion sign $t-p$ is held to show that expressions in which a pragmatic sign occurs are not propositions. They are not true or false because they cannot be negated. This appears to us to mean that there is no sign which states the negation of the assertion sign itself. (E. p.337.) Such a view is maintained by Reichenbach despite the fact that it is conventionally held that every proposition in symbolic logic which is put on a separate line is considered asserted unless

otherwise stated. Yet we negate these propositions.

It seems immaterial that there is no negative sign to correspond with an assertion sign. The proposition that is asserted can still be true or false. Just how the absence of negation of the actual sign of assertion itself makes it a pragmatic sign in contrast to other logical signs is not disclosed.

Again, expressions including pragmatic signs are said to be "instruments", in an "assertive mood". Such a theory would make every proposition in symbolic logic and every written sentence of English an instrument and not a proposition.

It can be claimed instead that no proposition or sentence can be true or false unless it is asserted. It is true that an assertion sign such as the period is not itself ever negated, and that in writing down a false sentence we still assert the sentence. But the possibility of a sentence being true or false, or the possibility of a yes assertion being made a no assertion, depends upon the sentence being an assertion in the first place.

17.44 There is a second group in the assertive sub-class. This consists of the moods: indicative, subjunctive and conditional. The first expresses assertion, and the others "express either absence of assertion or the assertion that the clause is false, i.e., the assertion of

the negation of the clause". (E. p.338.)

Because these categories are solely meaning analyses of the combinations of certain words, it is better to replace them by a full statement of the positions which the words may occupy in order to form sentences. For example, if we could say that If he be your friend, he will help you is a sentence of modern English, it would have to be stated in the formation rules of English that be is the only term which will fill the blank in a sentence of the structure If $m_1^1 - m_1^3 n+0, m_1^1$ will $v+0 m_2^1$.

The "mood" meaning is incidental here, and no more pragmatic than any other statement which involves people. The same theory and the same tests concerning syntactic uniqueness apply to the treatment of other terms such as should and would as pragmatic logical terms. (See E. p.338 foll.)

17.45 The second sub-class consists of interrogative terms, for example, interrogative pronouns and adverbs, and the question mark. Questions are held to be in a pragmatic mood because they have a determinate aim, a desire to gain knowledge from a listener. They merely express this desire but do not say it, whereas in the cognitive field, their correlates are of the form I wish to know the answer to this question. As before, this expressive nature is also said to be evident from the fact

that they cannot be negated. (E. p.340.)

Firstly, it can be said in answer that all language as a means of carrying or acquiring information is used for a determinate aim. Questions are no more pragmatic in this regard than any other forms. Then as previously, it can be held that the absence of negation of a question sign is immaterial and does not define it as pragmatic.

And lastly, it can be claimed that intonation in the spoken language, the question mark in written language, and interrogative pronouns etc. in both, are signs equally as capable of denoting as any other signs in the language. There is no essential difference between them, and if they are considered not object language signs but logical ones, it must be for reasons of a distributional nature.

17.46 Questions are to be subdivided into three kinds, "according as we ask for an argument, a function or a logical term" in the answer. (E. p.340.) (It is interesting to find a subdivision of questions which could be considered against that made by Fries. See appendices 5.5 and 17.7.) But because Reichenbach does not clearly distinguish the three kinds of symbols his attempt at classification does not fully succeed. Other problems also arise.

For example, what is said to give rise to a function answer, as in What is the colour of your house?, but it can

also cause an argument one as in What is that thing? There appears to be no reason either why the answer to the question about colour cannot be said to include an argument using a second type function. Again, how is said to ask for a function, but the answer By car to the question How did you go?, seems ambiguously a function or an argument.

However, Reichenbach also points out some interesting formal features. For instance, he shows that questions of the kind using the verb do in the initial position of the sentence, elicit a yes or no answer. For example, Did you go?, Did the men want it?, etc.

17.47 The third sub-class comprises imperative terms, the imperative mood and words such as shall and would, but it offers further evidence of arbitrariness. (E. pp.342-3.) For example, need and must are considered denotative in contrast to shall and would without sufficient reason. Nor are the two meanings for permission admissible, because the remarks about the meaning of the second apply also to the first.

The attention given to various individual words, here also makes us enquire why such words are not considered denotative. For instance, words like believe, usually held to be pragmatic, can also be held to be denotative because they belong to the function or verb variable. If

this is true, then there is further reason for not accepting Reichenbach's line of thought in 17.42, where he says no pragmatic term is denotative. (Believe in such sentences as I believe John is here is not part of a tautology, and so it cannot be treated like the all-operator on E. p.324.)

Arbitrariness of a different and less important kind is evident in the fourth sub-class, where it is said that ouch is a logical term because although it can be coordinated to the sentence I have pain, it cannot be negated. (E. pp.434-4.) However, according to earlier remarks by Reichenbach, I have pain cannot be negated either, since it is an assertion.

17.5 General Suggestions.

17.51 The whole section on logical terms concludes with the statement that much work still remains to be done and outlines only have been given. In particular, pragmatic terms are in need of analysis and formalization. As a result of the preceding details of criticism some general suggestions may be given.

Whether a term is pragmatic, semantical or syntactical, is entirely incidental to whether it is a logical constant (as defined in 4.31) even if we consider the distinctions valid. The distinction between semantical

and syntactical can, however, be disregarded by 17.31, and we would prefer to use Carnap's term, autonomous symbol¹, to express both the object language and metalanguage nature of a logical constant. Some further attention however may be given to pragmatic and semantical terms.

17.52 The pragmatic have been distinguished by Reichenbach from the semantical on the grounds that pragmatic sentences aim to influence the listener, and cannot be called "true" or "false". Semantical sentences on the other hand are always "true" or "false". (See E. pp.17 ff.)

It is also held that sentences in any of the moods of English are to be called pragmatic, as we have just seen. But since we hold that no sentence in English may occur without a sign of assertion, interrogation or command, it must follow that there are no sentences in English which are semantical.

We wish to reject these views and submit the following. There are three major groups of sentences in English which each have individual symbol orders in linear sequence. They are statements ("assertions", or sentences in the "indicative mood"), questions ("interrogative mood sentences") and commands ("sentences of the imperative mood"). The symbol orders corresponding to the three groups may be stated quite precisely as part of the initial set and formation rules of the language, and will be purely

syntactic in nature. Fries and other linguistic scholars support this.

Some sentences of the statement form have been chosen by Reichenbach as semantical, while others, namely those which involve a statement of a person's emotions or mental attitudes, such as I believe Z, have been called pragmatic. This is just a descriptive meaning distinction, and not at all formal. English makes no differentiation of form between the two kinds.

Even on the meaning level, the claim that pragmatic statements cannot be called "true" or "false" cannot be held. I believe Z, I presume Z, I hope for Z, If I were you I would go, etc., can all be either "true" or "false". Questions and commands, however, can be listed as pragmatic and not semantic because of the meaning analysis that they are not "true" or "false". But once more we can claim that this meaning distinction is quite incidental to the logical structure of the language.

17.53 The distinction between pragmatic and semantical could perhaps be admitted if the terms corresponded closely to certain individual sentence forms. But as we have seen, sentences of the statement form are sometimes pragmatic and sometimes semantical, and the principle of separation is a meaning one. Indeed, the meaning definition of what is pragmatic is rather loose. For

instance, it is said by Reichenbach that "communication always represents a form of influencing the listener", yet only pragmatic sentences are given this meaning characteristic. (E. p.17 foll.)

We would rather accept a differentiation between the emotive and referential use of language as provided by Ogden and Richards in "The Meaning of Meaning"⁴ and by Richards in "The Principles of Literary Criticism"⁵. Then we would consider that no sentence is used without some sort of emotive significance, even if it is only to arouse an attitude of interest in a listener when he hears a statement asserted.

Those sentences usually considered pragmatic by logicians are just one group of sentences whose emotive values have been picked out from the whole body of language. It is consequently possible to consider pragmatic as a term in the study of emotive values of words, and semantical as a term in the study of referential values of words. It is suggested then, that we may consider the theory of pragmatic and semantical logical terms and sentences of no great value in the study of the syntactic structure of a language, since pragmatic and semantical merely describe two ways of approaching the meaning of any structures whatsoever.

17.54 It is not denied, however, that a calculus

of a pragmatic kind could be formulated as a sub-calculus of the language. The values of the noun, adjective, and verb variables, and of the small word classes could be limited to those which would be considered pragmatic on a meaning basis, although it would probably be more useful to replace this term by another. The constants would, however, normally include non-pragmatic ones. If only certain sentence forms were to be used, then these would be provided also.

Further, if it were desired to consider only structure, and not meaning, then a calculus could be provided which for example used only commands. Reichenbach lists a number of works which treat a logic of commands. (E. p.344.) It is possible to imagine such a logic, often called a logic of value judgments, re-organized in the light of a full knowledge of command syntax in the English language.

17.6 Extraneous Terms.

17.61 Reichenbach goes on to list terms which do not fit the classes of logical terms already given. (E. p.344 foll.) All the terms so far discussed are said to occur in the object language (although we have seen that this is not the case because some occur only in the meta-language). However, conversational language is said to

contain more than one language system. It includes (1) terms of the metalanguage, and (2) terms of languages of fictitious existence.

17.62 Some terms of the metalanguage are

(a) syntactical: sentence, clause, word, speech, noun, letter, preposition; (b) semantical: denote, express, true, false, probable, analytic, synthetic, necessary, possible; (c) pragmatic: assert, assertion, presumably, of course, doubtful, meaning, command, permission.

On the contrary, we consider that all these words belong to the object language of English, for they behave the same way formally as any other object values of the variables to which they belong, and may be classified accordingly.

It is true that many of them refer to features of syntax of English, but this does not make them any different in character from ordinary object terms as far as their use in the language is concerned. They obey exactly the same rules of formation and transformation. Therefore, they may be understood as terms with metalanguage reference which occur in the object language.

17.63 The second group of extraneous terms, said to occur in languages of fictitious existence, also observe exactly the same syntactic rules as any other English object language terms. There is no formal differentiation.

The various fictitious languages which Reichenbach lists are separated from the rest of the language on a meaning basis only.

When it is claimed for many terms of "fictitious existence" such as perceive and see and any other terms of a mental kind, that they may be reduced to terms of physical existence, that is, to bodily states of the object language we neither agree that this is so, nor that this has any bearing on the syntax of English. The theory just satisfies the claims of logical positivism, and is totally independent of any syntactic analysis of English.

17.64 Another objection may be made when it is said that possible, in Peter's coming is possible as an interpretation of Peter will possibly come, is an improper term of the object language. This is held to be so because possible makes Peter's coming denote an event in the realm of fictitious existence and this shifts the level of language.

But in answer it can be claimed that since the language of fictitious existence includes arguments which are real (necessary), possible and impossible, and therefore permits an argument which is real at one time to be one which is possible at another, then there is no reason why natural language cannot do the same, even though it

might do so in a different way. Similar ideas can apply to other English words such as necessary and impossible which are held by Reichenbach to be improper.

That there is not a shift in the level of language can be supported by more fundamental views. When the meaning of possibility occurs in English, there is no formal sign, no grammatical category, which is inescapably required in order to present the concept. The term possibly, for example, is merely a value of a+ly and behaves just like any other value of a+ly. Impossible and necessary also occur in the same way as any other values of a. To call them "improper object terms" is to refuse to accept the syntax of English, and to draw upon comparisons with symbolic logic calculi so that their structural forms are imposed upon it.

Reichenbach thus goes on to say that the improper use of these terms can be corrected by constructing a calculus which tells us exactly what they do in the object language. (E. p.349.)

We maintain on the contrary that the use of these terms in the object language is quite proper, and that their meaning is quite unambiguous. If we say something is possible, impossible or necessary, our meaning cannot be mistaken. It is not at all necessary that we should reconstruct English so as to make these meanings

indispensable formal features, or grammatical categories.

17.7 APPENDIX: Basic Sentence Types.

17.71 The sentence types observed by Reichenbach in his chapter on conversational language and those formalized in solutions to exercises parts III and VII were collected, symbolized, and compared with the sentence types which Fries and Harris have considered important common ones. (See appendices 5.5 and 10.5.) In apparently random fashion he has included quite a lot of material. Coverage of the tenses is quite detailed.

At least a few sentences not allowed in the Harris system are considered. Thus use of the sequences listed in 10.5 under (f), (h), (j) and (o) can be remarked. (See Reichenbach's solutions to 54-6, 47-8, 59-1, 59-3, and 54-5. Uses of there in 54-7, so...as in 54-7, and more than in 48-4 also occur.) Others may not be of great interest, and Harris could have equally noted them in discussion.

But from the total array of sentences, Reichenbach does not indicate to any exact extent an initial set, though he obviously accepts some forms as being of common importance. More important, he gives no true analysis of any sentence type similarity or difference. It has consequently been thought unnecessary to list the variety of

sentences he observes and to present only the results of comparison with the Fries and Harris appendices.

Omissions which he makes from their lists are important because they are common forms. We were unable to find examples of the following which are in the Fries appendix: formulas (8), (9), (12) and (c). He also does not observe the substitution groups of (7) following, and his forms of questions are only loosely given. Sequence sentence patterns are not remarked. It is interesting that the three types of answers to questions which he records (E. p.340) can be resolved into the two kinds given in the Fries appendix.

Harris appendix types which could not be found are as follows: (7), (8), (9), (12), (13), (16), (18), (19), (30), (33), (43), (47), and some of (49). Other omissions: some uses of the infinitive, prepositions, and modification sequences (as in 5.33).

The above lists are indicative rather than exhaustive, for a fully thorough study has not been felt necessary. It is obvious that Fries and Harris present more workable and interpretable formulas and they have been given more attention.

17.72 But differences between Fries and Harris can also be noted. Fries exhibits in the appendix some sentence types which are quite important and not developed

in the Harris system: (2), uses of the substitution groups of (7) following, the noun construction of the subject in (8), (a) and (b). In addition, Harris covers answers to questions only briefly (M.U. p.175),⁶ and ignores uses of the interrogative words noted by Fries in 2. of the appendix. Sequence sentences are included to some extent in (49) of the Harris appendix, but not treated thoroughly.

On the other hand, there are some omissions in the Fries appendix which are to be found in the Harris. They could mostly be considered expansions through formation rules, although Fries does not develop them this far. But he does observe many more sentence types in his book than recorded in the appendix. An exact comparison with Harris has not been made. It can still be maintained, regardless of omissions and inclusions, that Harris' system is better because of the more exact detailing of the word classes. Compare the use of sub-script lettering in Harris with the absence of it in Fries.

These comparisons, and observations elsewhere, serve to show that more complete recording needs to be made of English sentence types so that enquiry can be made into the establishment of initial sets and formation rules. Appendix 13-5 does record a number of short types but does not claim to be complete in coverage of even short common

forms. It can be compared with the other appendices.

17.73 A few random formulas taken from Reichenbach's solutions are supplied as examples. English syntax notation is contrasted. Interpretations are listed separately and clues to abbreviations such as d for drive are omitted so that incomprehensibility is shown. The variation of interpretation forced on the supposed constants of brackets, commas and symbol order becomes apparent. It arises because of the lack of natural language syntax material incorporated.

18-f-6

$$\underline{(x) (y) [f(x, z_1) \cdot n(y, z_1) > i(x, y)]}$$

18-A-7

$$\underline{(x) \{ [m(x) \vee w(x)] \cdot wo(x, y_1) > c(x, z_1) \}}$$

18-B-6

$$\underline{[x]r(x) \cdot s(x, y_1)}$$

47-4

$$\underline{t_1 = (\gamma t)yr(t) \cdot d(z_1, t)}$$

$$\underline{b(x_1, t_1)}$$

47-6

$$\underline{x_1 = (\gamma x)f(x, u_1)}$$

$$\underline{y_1 = (\gamma y)s(y) \cdot st(y, x_1)}$$

$$\underline{z_1 = (\gamma z)cr(z) \cdot w(x_1, z)}$$

$$\underline{w(y_1, z_1)}$$

$$\underline{t^{pl} n_1+s \text{ of } \bar{n}_1+o \bar{n}_2+o \vee +d m^3 n_2+s}$$

$$\underline{t_1^{pl} n_1(s) \text{ or } n_2+(s) \vee +ing p_b t_2 \bar{n}_1+o \bar{n}_2+o}$$

$$\underline{BE n+s \text{ of } t_2 \bar{v}+n \bar{n}+s}$$

(Note: (s) denotes vowel change)

$$\underline{\text{Something BE } a+o p t n+o \text{ of } \bar{n}+o}$$

$$\underline{\bar{n}_1+o \bar{n}_2+o \text{ BE } v+n p t n^{th}+o \text{ of } t n+o \text{ of } t \bar{n}_3+o}$$

$$\underline{t n_1+o \text{ that } v+d m_1^3 n_2+o d}$$

$$\underline{v+s m_2^3 n_3+o}$$

47-7

$(x) \{m(x) \supset (\exists y)md(y, x) .$

$h(y) . z(md(z, x) \supset (z = y))\}$

48-2

$v_I = (\exists v) [d(x_1)]^*(v)$

$u_I = (\exists u)r(u, z_1)$

$m(v_1, y_1, u_1)$

48-6

$p_1 = \frac{(\exists x)s(x) . r(x) . pr(y_1, x)}{dr}$

$p_2 = \frac{(\exists x)n(x) . r(x) . im(x, z_1)}{dr}$

$mi [(\exists v)p_1^*(v), y_1, (\exists u)p_2^*(u)]$

51-B-7

$(x)(y) [g(x) . i(y) \supset h(x, y, t)]$

$t \ a+o \text{ has no } n_1+o \ c' \ n_2+o$

$t \ n_1+o \text{ of } \bar{n}_1+o \text{ made } \bar{n}_2^a+o \ t \ n_2^a+o \text{ of } t \ \bar{n}_3+o$

(Note: the indice a, denotes the referents
are the same)

$t \ n_1+o \text{ of } \left. \begin{matrix} n_2+o \\ a_1+o \end{matrix} \right\} n_3+o \text{ make } t \ \bar{v}+n \ \bar{n}_1+s$

$a+o_2 \text{ of } t \ n_4+o \text{ of } \left. \begin{matrix} a_3+o \\ n_5+o \end{matrix} \right\} n_6+o$

$p \ t \ \bar{a}+o \ \bar{n}_2+s$

$n_1^{sg} \text{ is a+er than } n_2^{sg}$

53-2

$(\exists x)(\exists f)(\exists y)b(x) \cdot sh(y, z_1) \cdot$

$f(x, y) \cdot \gamma(f) \cdot \delta(f)$

53-7

$sp(x, y) \cdot g(y) \supset (\exists z)(\exists f) \cdot v(z) \cdot$

$rf(y, z) \cdot f(x, z) \cdot \gamma(f) \cdot \delta(f)$

$t \ n_1 + o \ v + d \ a + ly \ p_b \ m^3 \ n_2 + o$

$n_1^{sg} \ is \ n_2^{sg} \ v + n \ a + ly$

Interpretations:

- 18-A-6 : All followers of Oscar Wilde imitated his
manners.
- 18-A-7 : All men or women working at the Douglas factory
are citizens of the United States.
- 18-B-6 : Something is rotten in the state of Denmark.
- 47-4 : Thomas Hobbes was born in the year of the defeat
of the Armada.
- 47-6 : The serpent that stung thy father now wears his
crown.
- 47-7 : The miserable has no medicine but hope.
- 48-2 : The destruction of Carthago made Rome the ruler
of the Mediterranean.
- 48-C : The production of synthetic rubber made the
United States independent of the importation
of natural rubber from the East Indies.
- 51-B-7 : Gold is heavier than iron.
- 53-2 : A burden weighed heavily on his shoulder.
- 53-7 : Gossip is a vice enjoyed vicariously.

Compare the two-place functions:

- 47-4 : $d(z_1, t) = z_1$ [was defeated at] time t
- 47-6 : $w(y_1, z_1) = y_1$ [wears] z_1
- 47-7 : $md(y, x) = y$ [is the medicine of] x

53-2 : $\underline{f(x, y) = [f \text{ is a function of}] x \text{ and } y}$
 $\underline{\text{or } x [is related by f to] y}$

53-7 : $\underline{sp(x, y) = x [speaks to] y}$

18-A-6 : $\underline{f(x, z_1) = x [is a follower of] z_1}$
 $\underline{m(y, z_1) = y [are the manners of] z_1}$
 $\underline{i(x, y) = x [imitated] y}$

18-B-6 : $\underline{s(x, y_1) = x [is situated in] y_1}$

Compare also the three place functions:

48-6 : $\underline{m[(\exists v) p_1^* v, y_1, (\exists u) p_2^*(u)] =}$
 $\underline{A [made] B [independent of] C}$

48-2 : $\underline{m(v_1, y_1, u_1) = v_1 [made] y_1 u_1}$

51-B-7 : $\underline{h(x, y, t) = x [is heavier than] y [at] \text{ time } t}$

Further examination also shows that style of symbolization is not consistent. For example 47-6 could provide an event-split because of the use of that, and descriptive notation could be used for the defeat of and the year of in 47-4 (thus $x_1 = (\exists x)d(x, z_1)$ etc.) The use or non-use of \forall and \exists is not consistent throughout the solutions. Although only a small number of formulas are recorded here, they are indicative of the whole set.

Meaning equivalences for example, which have to be made before formalization as in 18-B-6, are common.

1. Carnap, R., The Logical Syntax of Language, (London, Kegan Paul, Trench, Trubner & Co., 1937), p.17, p.156.
2. Carnap, R., The Logical Syntax of Language, (London, Kegan Paul, Trench, Trubner & Co., 1937), p.292 foll. See also modification of Carnap's theory in 21.1 below.
3. Consider Jespersen, Otto, The Philosophy of Grammar, (London, G.Allen & Unwin, 1924), for example, p.150 foll. Also by the same author Essentials of English Grammar, (London, G.Allen & Unwin, 1933), for example p.124 foll.
4. Richards, I.A., and Ogden, C.K., The Meaning of Meaning, (6th ed., London, Kegan Paul, Trench, Trubner & Co., 1944).
5. Richards, I.A., The Principles of Literary Criticism, (London, Kegan Paul & Co., 1925).
For discussion about the exact nature of the differentiation between emotive and referential uses of words see also Black, Max, Language and Philosophy, (New York, Cornell University Press, 1949), Chapter IX.
6. Harris, Zellig S., "From Morpheme to Utterance", Language, 22 (1946), p.76.foll.

PART IV.CONCLUSION: RUDOLF CARNAP AND GENERAL IDEAS.CHAPTER 18.INTRODUCTION.

18.01 It has been seen that an important example of symbolic logic is insufficiently familiar with the structure of English to provide an adequate mechanism for its formulaic representation. But because Carnap has provided some significant developments in logic, an examination may be made of the usefulness of some of his theories. This does not mean that his philosophical outlook is accepted. On the contrary, logic is treated only as a deductive tool.

The focal book for attention is "Logical Syntax of Language",¹ and some quotations from it will be given. Carnap points out that "logistics has taught people how to manipulate with precision symbols and formulae which are similar in their nature to those used in mathematics." (L.S. foreword p.XIII). But grammarians can now claim that such precise manipulation can be developed in linguistics, and so Carnap's further statement below must be rejected.

"In consequence of the unsystematic and logically imperfect structure of the natural word - languages (such as German or Latin), the statement of their formal rules of formation and transformation would be so complicated that it would hardly be feasible in practice." (L.S. p.2)

It is not difficult to support the view that if a natural language has a basic formal system which is only imperfect, it cannot work very well in practice. The users of a language must be agreed to use certain forms and transforms in order to understand one another. Although there are idiomatic and colloquial expressions etc. which lie outside of its system, there is no reason why, with sufficient knowledge, the basic logical structure of English can not be stated.

Soon, the statement that "only in a symbolic language has it proved possible to achieve exact formulation and rigid proofs" (L.S. p.3), will have to include the symbolic notation for the forms of a natural language.

Again, while there is some truth, as it has been seen, in Carnap's suggestion that syntactic concepts and rules can be of use in a general way in analysing word languages (L.S. p.8), there can be no agreement with the following:

"The direct analysis of these [i.e. the word languages], which has been prevalent hitherto, must inevitably fail.....
the syntactical property of a particular word language such as English, or of particular sub-languages of a word language, is best represented and investigated by comparison with a constructed language which serves as a system of reference." (L.S. p.8)

18.02 Some attention will be given to Languages I and II of L.S. in order to reinforce our contrary views in Part III. For it is clear that Carnap intends them to formalize word language sentences. "Languages I and II do not only include mathematics...., above all, they afford the possibility of constructing empirical sentences concerning any domain of objects." (L.S.p.11)

In examining the two languages, important questions will arise on the nature of logical variables and constants and allied problems. The debt to Carnap, and also to F.W. Harwood, in laying down the basis for the views taken of them in this paper, has already been recognized. However, differences with Carnap will be brought out.

For example, it will be held that the syntax of Language I is not entirely formalized within that language itself. More importantly, with respect to discussion here, it will be claimed that the view of Carnap and others that the difference between a syntactic and a descriptive element can not be established, is not true. As a result, a difference between syntax and logic will be outlined, although it will be seen why it has been convenient to treat the two as synonymous.

18.03 Further questions which concern studies in English syntax as well as in symbolic logic will also arise. The concepts of equivalence and implication will be treated and it will be seen that they vary in meaning for various purposes. Interpretations for work

in English syntax will be given.

The uses of semantic and syntactic transformation rules will be discussed and they will be differentiated from each other. The introduction of the first into a syntactic system can be compared in nature with the introduction of empiric laws into a deductive system of science. The claim that the syntax of English offers scope for the development of varied and not yet developed deductive calculi is made.

Further study of transformation rules will show that Carnap can not uphold the statement that they necessarily determine the logical symbols of a language. The logical symbols can be established from the formation rules alone.

18.04 Finally, some attention is given to English syntax in particular. Reasons why the paper has tended to eliminate consideration of the full meaning range of English words and sentences will be given. It should be understood that the referential uses of words are stressed throughout.

Brief discussion about machine uses of English syntax is made, and the paper ends with an appendix illustrating formation and transformation formulas of the language.

¹ Carnap, Rudolf, The Logical Syntax of Language, (London, Kegan Paul, Trench, Trubner and Co., 1937). For convenience this work will be referred to by L.S.)

CHAPTER 19.

REMARKS ON LANGUAGE I.

19.0 Introduction.

It may be argued that because Language I uses positional co-ordinates instead of proper names for its objects, an entirely different symbolization of English from the one offered in the simple calculus of functions is put forward, and that this may be more useful. Both questions will receive some attention and negative answers will be found.

The junction symbols will receive some attention in relation to a different problem. Carnap has claimed that the postulates and rules of inference of a language determine their meanings. It will be found necessary to modify this in a way which he has not shown in "Introduction to Semantics." ¹

19.1 Problems about Positions, Predicates and Functors.

19.11 First of all "In order to express a property of an object, or of a position, or a relation between several objects or positions, predicates are used." (I.S. p.13). Now we may ask when an English form designates positional analysis and when it designates predicate analysis. Even though objects are dismissed in favour of positional co-ordinates, there is still the old problem

of how we know when any given form is a predicate and when it is not. When are we to use a number for a particular English symbol or expression and when are we to use a predicate symbol only?

We are not given any precise information concerning English syntax in the following, where particular examples of predicates and numbers are picked out, but where no overall principle is given:

"Examples: (1) Let Blue(3) have the meaning: the position 3 is blue; in a name-language: Blue(a) is 'the object a is blue.' Let Wr(3,5) mean: 'the position 3 is warmer than the position 5'; in a name language Wr(a,b): 'the body a is warmer than the body b'; Fa(a,b): 'the person a is father of the person b' and so on. (3) Let T(0,8,4,3) mean: 'the temperature at the position 0 is as much higher than at the position 8 as the temperature at the position 4 is higher than at the position 3.'" (L.S. p.13)

Here, also, all the objections to Reichenbach's use of brackets and commas and symbol order for widely varying semantic and syntactic values, which do not come under the headings of functions (predicates) or arguments (positions), apply to the formulas given. So we supply criticism on two grounds: (1) that we are not told how we are to recognize a position or a predicate and (2) we are supplied with formulas which are incomprehensible unless the natural language sentences they formalize are first known.

The whole of Language I never clarifies either of these aspects. Are predicates and positions to be recognized on the meanings of words only, even in sentences? Is there some meaning concept which is to be drawn on independently of syntax? (This scarcely seems possible, since syntax exists to carry the meaning of words in sentences).

19.12 When the predicates are treated as functors criticism (1) arises again. Numerals in serial order are introduced as values of a predicate (such as temperature) whose natural language name is retained in abbreviation. How do we know when to retain this name and when not to? Why should temperature in the temperature at the position 3 be retained as a functor, and house in the house at the position 3 not be retained in this way? There must be a semantic difference here.

Three important remarks may be made at this point:

(a) Even if the descriptive functor were replaced by a numeral, this numeral would have to receive different syntactic attention from a positional numeral; (b) it is rather interesting that in te(3) = 5 given by Carnap as an example of functor use there is no way of telling that 5 does not designate a position instead of a value of a descriptive functor; (c) because natural language words must be retained as functors in Language I, it is not completely numerical.

19.13 As we have seen previously in the study on Reichenbach, some words may be treated either as predicates or as objects with a predicate split. (Compare house in The house is new and This is a house). So also in Carnap there is nothing to stop some words from being treated either as functors, or else as positional co-ordinates with predicate or functor values, depending upon the positions they occupy in English sentences. That a word may be a property at one time, and an object plus a property at another in a natural language, does not depend solely on the nature of the word itself, but upon the syntax used. So the syntax of the natural language must be known in order to put the information contained in that sentence into artificial language form.

In summary then of the previous sections, as the symbolic languages are now used, the artificial form represents multiple features of English syntax, and an expression like tdiff(3,4) = 2 is undecipherable if we consider the artificial syntax alone. Consequently, it is not agreed that logic provides the norm for deductive processes in natural language. On the other hand, the syntax of natural language could provide a better calculus if it were more precisely incorporated into logic. (Descriptive functors and not logical functors have been discussed because the last is a name for a numerical operation outside of natural language proper.)

19.2 More Problems about Positions and Predicates.

19.21 As we have stated, and as may be seen in the quotation in 19.11, when an object term is formalized it is split into positional co-ordinate plus predicate. But some terms are predicate terms only and have to be differentiated. We have to have some means of knowing why dog in the barking dog supplies an individual position (or set of positions. See L.S. p.150), while barking does not, since it is treated only as a predicate. This is especially important because in another expression such as the loud barking in The loud barking grew noisier, barking would have to provide the positional co-ordinate. But how we know this through the word-orders of English in combination with the use of the is never clarified in "Logical Syntax".

Carnap seems to suggest that inspection of the mere meanings of the words will tell us when to call a word an object with positional co-ordinates and when not to. (Consider for example the treatment of temperature in 19.11).

Further support for the view that this idea is invalid is evident in the examples below. Firstly, without considering syntax it is impossible to tell whether both members of an n n sequence such as hospital gardens are each split into positional co-ordinate plus predicate, or whether one is retained as a predicate only, or whether both are. Any word which is n/v or n/a ambiguous also requires syntactic attention.

Again, how do we know what position any predicate is attached to if we do not know the English syntactic structure which attaches it to an object? We have to be able to recognize the words with positional split in The lawn is green and The greens are in good condition or in The grocer is a man and The man is a grocer. In Cheese is good for you is cheese to be split into a domain of positions? (See L.S. p.150).

19.22 We have to decide from the structure of any given sentence, what term among others is going to supply the position we are going to refer to. This may sometimes be done by choosing the noun preceded by the, but for example in noun expansions, and in many cases where a determiner is not used, there will be difficulty. We may be provided with more than one position from which to choose as in The vegetable patch in the main street of the country town. The use of a positional co-ordinate or not could become a matter of intuition. The study of barking in 19.21 shows that the terms predicate and positional co-ordinate refer to particular English syntactic structures, as well as to particular semantic values such as temperature opposed to house. But as with predicates and arguments, their use includes too many varied linear sequences of word classes. Even if Carnap told us how to formalize a beautiful white dress with a wide lace hem so that a choice of one or more positional co-ordinates became unambiguous, then the formula would still be practically useless without a knowledge of this particular linear sequence in the first place.

19.3 "Constants" of Language I.

19.31 Having discussed the variables we may turn now to the one and two termed junction symbols, and see if there is a similar dependence here upon natural language.

It is said: "In a strictly formally constructed system, the meaning of these symbols....arises out of the rules of transformation." (L.S. p.18) This means that these symbols are defined within the artificial language system, and are quite independent of English. Of course, their meanings may be expressed in English, since anything may be expressed in a natural language which has a large enough vocabulary, and a sufficient syntax, but unlike the brackets, for example, these symbols should represent ideas which are definable in the artificial syntax alone, without the assistance of natural language expressions.

This is the case so long as the semantical rules of truth are included in the system to allow the truth tables to be developed. (L.S. p.20). Without the primitive ideas of truth and falsity neither the truth tables, nor the transformations would be comprehensible. (See "Introduction to Semantics"¹ for discussion relevant to this. E.g. p.vi, p.30 foll.) With their inclusion, the truth tables precisely define the junction symbols.

However, the equivalence sign is used not only to indicate identity of truth or falsity between two sentences as claimed in the truth tables. Let us take $\frac{C}{1} = \frac{C}{2}$ or $\frac{C \vee C}{1} = \frac{C \supset C}{2}$. Here we must interpret from the truth tables that the sign merely means that the left side and the right side of it are both true. (L.S. p.20). But in such sentences as $\frac{-C \vee C}{1} = \frac{C \supset C}{2}$ the sign is permitted to indicate something more. The truth tables show that the two sentences which are the parts of the equivalence have the same truth distribution. For such a formula there is equivalence of referential or empiric meaning content, as well as equivalence of truth or falsity, for each side of the equivalence sign. Although the use of the one symbol may be inconvenient, still no ambiguity results, for inspection of the transformation defines when this second meaning occurs.

19.32 We have now discussed all the major symbols used by Carnap for Language I except the operators, (x) , \exists , and \underline{K} . We have seen how the variables relate both to syntactic and semantic features of English, and how the brackets and commas in combination with variables have variant syntactic values. Without further discussion, it is also clear that the function symbols are, as in other logic systems, to be correlated with certain individual word meanings (or semantic values) in English, with some combinations of words (and thus syntactic features) entering. (For example, see L.S. p.19).

In the case of the operators, English expressions and not just individual signs are involved in the interpretation of each. (L.S. p.21). For example the definition of the limited universal operator, Every x up to n is, is a partial sentence. With the unlimited universal operator (or free variable) certain syntactic features of English as in n + s are a + o are involved. It is only when all or every or some can be used as individual terms directly correspondent with the operators, that the question of whether the operator concepts are syntactic terms in English can arise. But no answer can yet be given.

The K-operator is like the limited operators, but we disagree with Carnap by claiming that it does, in combination with other symbols, provide a sentence not a description. A description as outlined by Russell² and others can represent certain kinds of English structures which are not sentences. The use of the K-operator necessitates a full sentence correspondence, which should not be confused with a description, although the limits of what English structures may or may not be descriptions do not seem to have been made clear, even by Moore.²

19.33 In summary then, many of the problems which are met in the simple calculus of functions arise again in a language of positional co-ordinates, when we try to translate English into either

of these systems. It may be considered, however, that a language of positional co-ordinates could become independent of English syntax and we could rid it of such expressions as $T(0, 1, 8, 3) = 3$ where English syntax must be known in order to interpret.

The calculus could possibly be made essentially a number system, a guide in order to refer to space points in the world, and natural language words whether nouns, verbs or adjectives, would enter only as values of the positions. But as yet it is not clear how to deal with formulas such as the one above, although a solution might be possible. One great difficulty which may be insuperable is how to formalize relations without drawing on natural language syntax. For example, we must know in Tom works the machine that works is a relation and also that Tom operates on the machine, while in The works are near the town, works is not a relation and there is no transitive verb.

When the calculus is considered as a formalization of natural language, however, all the problems previously stressed have to be considered.

19.4 Other Problems in Understanding the Symbols.

19.41 There is a further point which requires attention.

".....let any postulates and any rules of inference be chosen arbitrarily, then this choice, whatever it may be, will determine what meaning is to be assigned to the fundamental logical symbols." (L.S.p.xv)

This has been modified in "Introduction to Semantics" in the sense that the syntactic arbitrary rules will not supply definitions of the symbols which are adequate for all semantical systems of object languages,^{and} in the sense that the postulates and rules of inference have to arise from the semantical rules of a given language. As this last is the case for Languages I and II which we discuss in this paper, the quotation still obtains concerning the meanings of their symbols, and is open for discussion below. (See "Introduction to Semantics", p.202 foll. and p.246 foll.)

If the claim about meaning definition were true, then the problems concerning the brackets and comma and symbol order would not arise. The fault may be that in the postulates and rules of inference these syntactic features have received no individual attention. No postulate or rule of inference, for example, is stated concerning either of the brackets.

The fault may also be that in the postulates and rules of inference, the sentences and equivalences force on the brackets, etc., a variety of meanings which are not easy to grasp. This may be more true than the previous supposition. In any case, the transformation rules do not provide any meaning definition which enables us to interpret $T(0, 1, 8, 3) = 5$ and similar constructions. The dependence on English syntax still holds.

19.42 Furthermore, although the transformation rules of Languages I and II may supply the semantic definitions of the function syllables, it is obvious that they do not supply the interpretation of the variables. The values of the variables remain unknown, although the symbols for the variables receive manipulative meaning through the rules. What is to constitute a functor, a predicate or a positional co-ordinate argument lies entirely outside the postulates and rules of inference given, though postulates in order to decide could be included. Carnap treats problems related to these in L.S. p.78 foll., where his discussion of physical syntax shows that the meanings of calculus symbols are also dependent on what they are applied to, outside of the T- rules. (Compare "Introduction to Semantics", p.246 foll., p.202 foll., and p.vi).

The interpretation of the symbols for functors (and predicates) and positional co-ordinates could be made clearer if argument terms were to arise only from the splitting of nouns which are countables into position plus functor features, while non-countables were never to give rise to positional arguments but only functors. Even so, there would still be some other features of English syntax to be considered, since as we have seen, whether a word is a countable or not can in some instances depend on where it occurs. For example, The coals are hot; Coal is a mineral; The room is circular; The circulars have been sent out. When Carnap says categorically that

an adjective (a property-word) is not a thing - word (which is comparable to a noun) he appears to overlook this feature and thus the n/a class. (L.S. p.297).

In any case Carnap does not limit the solitary use of predicates and functors to non-countables. It is curious that at the opening of the book it is the non-countables such as blue, warmer etc. which are treated as not containing arguments. (L.S. p.13). But later, we even have a countable like horse treated as a property with no internal positional split. (L.S. p.150). For Carnap recommends that horse, like most words in English, is a third type predicate, i.e., a predicate of a second type predicate which determines a space-time domain argument. The reason for this point of view is not at all easy to understand.

If most English words are to be treated as third type "properties or relations of domains" (L.S. p.150) then we have few second type property words left to determine the domains. (The problem of type level for horse also appears large. Cp. L.S. p.13, L.S. p.85 foll., and L.S. p.150).

19.43 Another problem in interpretation arises. All numerals in a co-ordinate language represent positions which have characteristics or properties. Natural language on the other hand uses words, about all of which we have to decide whether they can be

given a clear cut reference to a position in the world or not. It is to be noted that words become indispensable terms, in abbreviation, i.e., predicates and functors, in Carnap's co-ordinate languages.

We have to decide for example, whether green in Green is a beautiful colour is to be correlated with any particular positions in the world or not. In the natural language no positional reference is required. In the artificial one it may be considered necessary to reduce green to all the positions which have been experienced as green in the life of any individual, or individuals. It does not seem possible that they could ever be found out, and even if they were, the set of positional co-ordinates, plus necessary time references would be astronomical. For example:

year - gr. , gr. , gr. n
 1 1 5 8

year - gr. , gr. , gr. n
 2 3 15 31

etc.

Nouns like beauty and colour are open to the same considerations. Other nouns like horse, house and man would be more manageable but would still involve great difficulties.

Despite the views of L.S. p.150, it would seem preferable to give such nouns as the last single point expression. These are countables, and could be retained as words supplying positional reference. But the uses of the other nouns, along with verbs,

adjectives, and non n, v, and a words would have to be distinguished, and no inappropriate attempt at positional analysis would then be made. The green case above would not arise, because it would be distinguished from countables in comparable sequences. Nor would there be any attempt to find a positional reference for hit in The boy hit the ball while there would be one for The hit was a good one. A two-termed predicate would not be confused with a case of class membership.

We may now revert to the comment that Carnap's predicates and functors consist of natural language words in abbreviation. It appears that in order to use his languages, a knowledge of natural language syntax is a pre-requisite.

19.44 It was seen in 11.02 that the calculus of functions can be approached in two ways. The section above and the remarks to follow support the application of the same ideas to Carnap's languages of positional co-ordinates. It can be shown in an extreme fashion that from either point of view failure to give adequate attention to natural language syntax can make the use of such a calculus futile.³ This is obviously what we would expect, but there may be some need for further detail.

We could begin with the primitive ideas of the artificial language, position, predicate and functor. We could then rashly take

all the n, v, and a words and arbitrarily classify them as members of predicate, or position plus predicate, or functor classes, taking no account of the syntactic nature of the words except to separate them from the members of non n - v - a.

Thus there could be the semantic class for names of people, and another for terms with respect to the family, and another with terms for emotions, and so on with respect to various fields of knowledge, including those of science. Love, hate, fearful, tears etc. could be in the predicate class P, and father, family, maternal, birth, bear and so on in Q. Then Tom, Jane, Mary, Bill etc. could be in the position plus predicate class A, and animal terms such as dog, cat, feline, prowl, prey, pig etc. could be in the position plus predicate class B, and so on. The functors would be semantically distinguished and sub-grouped also.

Then $(\exists x) \underset{I}{A(x)} . \underset{I}{P(x)}$ would represent for example There is a positional co-ordinate x such that x is Tom and x is love. The brackets and symbol order of the logic syntax must be constant and so the partial sentence sequence which does not include love and Tom would have to be used always to interpret any other instance of a formula of the same kind.

The logic syntax can not vary in interpretation according to what words we pick out, if it is to be independent of natural language.

The symbol order and the brackets should have a defined syntactic value, which does not alter. (Cp. 20.31). If they do alter according to the syntactic nature of the words we pick out, then the logic syntax has certain values not internally but externally defined and is therefore incomplete.

The introduction of such rigidity however makes the calculus very limited in structural meanings. And when two and three place predicates are represented through the use of brackets and other symbols such rigidity creates incomprehensibility. Not only this, but for two and three termed predicates an arbitrary classification of nouns, verbs and adjectives would create even more futile interpretations than the one given above with Tom and love.

It appears impossible ever to use the idea of two-termed predicates in a system of symbolic logic applied to a natural language unless we know first of all that a particular word is, for example, a transitive verb. (Two-termed predicates could be a part of a description etc.) It is always fundamental to know what words constitute predicates, and to acquire this knowledge it is necessary first to become familiar with the structure of the language to which the words belong.

¹ Carnap, Rudolf, Introduction to Semantics, (Cambridge, Mass., Harvard University Press, 1942).

² See Schilpp, P.A., The Library of Living Philosophers, Vol. V, (The Philosophy of Bertrand Russell) (United States, Northwestern University, 1944) for the article by Moore, G.E., "Russell's 'Theory of Descriptions'", p.175.

³ See footnote 5 in "Survey" above.

CHAPTER 20.SYNTAX THEORY; OTHER LANGUAGES.20.0 Introduction.

It is wished to stress in this chapter the importance of Carnap's statement on what features of a language constitute syntax. Some of his theory concerning the formalization of the syntax of Language I (and any language) will be related to the formalization of the syntax of English.

Attention will be given to his explanation of how to formalize the syntax of a language entirely within that language itself. It will be found that he has not achieved the desired result for Language I.

Language II will be treated merely to illustrate that previous criticisms about lack of independence in symbolic logic still apply.

Such criticisms will be discussed further by considering briefly a given use of a logical calculus and by considering Carnap's neutral language.

20.1 Ideas about Syntax.

The syntax of a language, says Carnap, is concerned with the serial order of its elements. (L.S. p.6). The elements in our definition are morphemes. But the study of the serial order of

elements in sentences, which provides knowledge of what elements fill what positions in each sentence consisting of one or more positions, has not always been fully appreciated as the defining activity of syntax, although this view arises from Carnap's work.

For instance, we have seen that Harris is not aware of the importance of differentiating the formation rules of classes of morphemes in a two positional sentence for example, from that of a three, four, or five positional sentence etc. But Carnap establishes a unique number for every series of term numbers, and thus preserves both a statement of how many positions occur in a sequence and of what fills these positions. (L.S. p.54 foll.) Each English sentence with differing numbers of positions can be provided with separate rules which will include statement of what class symbols will combine with what others in any one position of any numerically defined sequence. (See 3.13).

Considerations such as these have enabled us to define what is a logical or syntactic element of a language. This is one of the most important problems in English structure, both in formation rules and in transformation rules. For example, depending on what we consider a syntactic constant or variable to be, will depend what transformations we consider syntactic and what ones we consider semantic. (See 22.2)

In providing a definition of a syntactic constant we find ourselves in more agreement with ideas in "Logical Syntax" than in the later works "Introduction to Semantics"¹ and "Meaning and Necessity."² The differences in point of view here and in Carnap will require some attention later.

20.2 Formalization of the Syntax of Language I within Itself.

20.21 The importance of positional enumeration in studying the serial order of the elements is stressed by Carnap when he holds that it enables the syntax of a language to be stated within that language itself without antinomies resulting. (L.S. pp. 53-4). In stating the syntax, the logical classes and constants extracted through positional study can be described by a system of arithmetization.

(L.S. p. 54 foll.) Since such a system does not fully bear upon the problem of whether a syntax of a language can be described within that language, its use is largely a matter of choice and convenience.

Again, in a descriptive syntax which does not arithmetize the syntactic symbols, i.e. designate them by numbers, it is a matter of choice, whether the syntactic symbols themselves may be used in the autonymous mode of speech, or whether new primitive terms for them are introduced, as for example Vär and etc. in Language I. (L.S. p. 54).

20.22 We may take the arithmetical formalization provided by Carnap and discuss some of its features.

Firstly, the term numbers replace not only the syntactic symbols for variables of Language I, but also defined values of

variables. Thus a defined numeral must receive a particular p^2 as its sign; and to get defined predicates we must replace particular natural language words like warn, red, square etc. by particular p^4 . We must do the same to get defined functors, and again must provide word correlates in order to have defined numerical values for them as in

$$\frac{fu}{1} \begin{matrix} I....n \\ \hline \end{matrix}, \quad \frac{fu}{2} \begin{matrix} I....n \\ \hline \end{matrix} \quad \dots \quad \frac{fu}{n} \begin{matrix} I....n \\ \hline \end{matrix}.$$

This is clear from the following:

"Since the factorization of a number into its prime factors is unique, the series of term-numbers in its original order may be regained from a series-number, and thereby also the language - expression to which the series-number is correlated." (L.S. p.56).

The language expression can only be obtained if unique numbers are assigned to every defined value of a variable.

So there is still the necessity to decide which words of a natural language are to be functors, predicates, or positional co-ordinates with predicate values, when we arithmetize the syntax of a language using predicates etc.

20.23 For any syntax Carnap gives a list of "general terms" which enable us to construct the formation and transformation rules in terms of arithmetic. All these terms are said to be definable within

Language I (L.S. p.58), and so the syntax of I does not need to draw on any primitive symbols outside of itself. This is only true if it is accepted that definitions I - 6 are all reducible to the primitive idea of "successor" (i.e. the rule of complete induction). (L.S.p.59).

With prod and sum a question may be asked. Do the definitions sum (o, y) = y and prod (o, y) = o in the regressive definitions of sum and prod (D2 and D3) provide a means of defining any numerical product or sum, and thus of eliminating these concepts? The definitions quoted relate to null, and it may be asked whether, therefore, they do not tell how they relate to other numbers. If this were to be so, then sum and prod would be primitive ideas of arithmetic outside of Language I, and consequently the syntax of I would not be formulated wholly within itself.

20.24 It is to be observed that the formation and transformation rules of the arithmetized syntax of Language I merely re-express the symbols and their arrangements, information which has already been given. (E.g. L.S. p.26). On the one hand we are provided with the numbers which are to stand for the individual symbols (e.g. D25), so that we merely replace a symbol by a number according to definition (cp. L.S. p.55); on the other, we are provided with the rules of combination and transformation which are exactly equivalent to previous statements of rules for the language (e.g. L.S. p.26).

This really means that after the syntactic symbols and rules of a language have been found out, we merely substitute numbers for the symbols and state the same rules again in a different way. As before, the interpretations of the symbols are ignored. What is to constitute a functor or a predicate is totally obscure and previous concern about the difficulties of interpreting these at all still holds.

20.25 The restatement of the rules is rather inconsistent. In the section on formation rules only certain symbols are defined so that a unique number is correlated with them, while others such as the operators and the brackets, are defined as they occur in certain combinations of numbers. (Cp. D26 and D23). The rules for the use of the comma are never given and we can only observe its use. The reason for this is not clear.

In the case of the comma and the brackets a problem arises as before. Since the use of the comma is not stipulated, and since the definition of the use of the two brackets does not supply their interpretation, there are variable meanings for symbol orders which include them. For example the interpretation of D56 Frei (s, x, n) is entirely different from the interpretation of D45 Verkn (x, y, z).

D56 = The free variable s occurs at the nth place in x and

D45 = x is a junction of y and z.

Different interpretations are supplied for other instances of the brackets and comma. We can not tell from transformation rules,

nor from any part of the syntax of Language I, how to understand any particular case. The formalization of the syntax is therefore incomprehensible until Carnap by choice gives the natural language interpretation. Brackets, commas and symbol order have no definable, recognizable values wherever they occur.

20.26 Sections 20.22 following have shown that the syntax of Language I is not wholly composed of Language I because all the symbols of the syntax language are not reducible to terms of Language I. (Cp. L.S. p.58). The need for an understanding of natural language syntax makes the artificial language dependent.

The dependence upon English or any other natural language could possibly be eliminated by clear definitions of the values of all the symbols and of symbol order, but it would severely limit the sorts of expressions which could be formulated. All the variety of interpretation for the occurrence of the symbols would have to disappear. However, another solution to the problem could be gained by introducing the syntax of a natural language so that variety could be retained.

20.3 Other Examples of Symbolic Dependence.

20.31 The same general remarks concerning dependence on natural language hold for Language II. (L.S. p.83 foll.) For example, it includes predicate and functor expressions as well as numerical expressions, and predicate and functor arguments as well as numerical arguments.

As in Reichenbach there is also the problem of type level for arguments, predicates and functors, type level depending on the use or non-use of positional numerals for words. (L.S. p.84 foll.) In the artificial language itself, the method of finding out the type level of a symbol is quite clear, as it concerns only the arrangements of the numerals and brackets, and is independent. But what is to be considered capable of taking positional numerical formalization or not in the first instance, depends directly upon the syntax of the natural language being formalized. (If there were no word class overlap in a language, then it might be easier to find a means of correlating artificial language terms uniquely to each set of words, but when there is class cleavage it is not so.)

Here again there arises not only the question of how the functional and higher functional calculi are to be interpreted for English, but how they are to work as independent systems. It may be objected that if the symbolic logic calculus is not used as a formalization of natural language, then it is an independent mechanism. But the discussion of the brackets, commas, and symbol orders should make it clear that this is not true at present.

In addition, the works of Reichenbach, Carnap, Russell, Lewis and Langford, Tarski and other prominent logicians, show that the use of the words of a natural language consistently makes the natural language provide the interpretation.

In view of these remarks an attempt such as that by Woodger³ to axiomatize information through symbolic logic, ought to receive attention. Although the present writer is not a biologist and therefore can not fully examine the field he took, one outstanding feature of his system can be distinguished. He provides basic terms whose explanations show clearly that they include not only semantic information, but syntactic material of English. These terms are not few but many, and enter the system as constants. This occurrence is so frequent that there scarcely seems to be a formula without one. It can consequently be claimed that they do a great deal to make the system interpretable.

Consider whether the formulas in "The Axiomatic Method in Biology"³ p.65 foll. would be understandable if the English syntax of the primitive signs had not been explained earlier. Note also that Tarski in the same book appears to find it necessary to include syntactic material when he discusses how certain of such signs are to be interpreted. (See "The Axiomatic Method in Biology", Appendix E, §1; " $x P y$ means that the thing x is a part of the thing y ," etc.) Whether a sign is a noun, or another part of speech, becomes clear.) Finally, take the fact that Woodger on p.32 uses two different signs for what are called the "logical" constants of father of and fathers of. It is such exact syntactic as well as semantic representation which overcomes variability of interpretation as noted before.⁴ (See 19.44, paragraph 7. Compare also 20.26).

20.32 For the reason that questions which arise in Language II have been discussed in Language I and in the study on Reichenbach, it will not be given further attention. However, although stress has been placed upon the simple calculus of functions and to some extent upon the higher calculus, some attention may now be given to the class calculus.

It has generally been placed on one side because the recent practice of logicians is to consider it included in functional calculi. Problems which have been met concerning them would also arise with the class calculus. (Consider "Critical Thinking" by Max Black, p.115 foll.⁵)

But Carnap has maintained that a calculus can be set up which covers the calculi of both simple and higher functions and which can yet be given either property or class interpretation in a natural language.

".....we shall indicate how a shorter method of writing can be introduced in which arguments and operators can, under certain circumstances, be left out.The result of this symbolism can be paraphrased in terms either of 'properties' or of 'classes', as one wishes." (I.S. p.134).

This means that a class variable argument expression in the artificial language does not necessarily correspond with a noun type construction and that a predicate does not necessarily correlate with an adjective or verb or any other type of construction. A predicate

or argument can be introduced in any case. Thus interpretation from the formulas into English would be made more confusing, because even greater variety of English syntax structures would be represented by the variables.

Max Black considers that such a language would not be useful.⁶ We consider also that unless such a language somehow became entirely independent of natural language structure it would fail.

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- ¹ Carnap, Rudolf, Introduction to Semantics, (Cambridge, Mass., Harvard University Press, 1942).
 - ² Carnap, Rudolf, Meaning and Necessity, (Chicago, University of Chicago Press, 1947).
 - ³ Woodger, J.H., The Axiomatic Method in Biology, (Cambridge, University Press, 1937).
 - ⁴ The use of constants can be compared with Carnap's suggestions about a language of constants in L.S. p.194.
 - ⁵ Black, Max, Critical Thinking, (2nd ed., New York, Prentice-Hall, 1952).
 - ⁶ Black, Max, "Carnap's Semantics", The Philosophical Review, 58 (1949), p.264.

CHAPTER 21.

SYNTAX, LOGIC, AND DESCRIPTIVE ELEMENTS.

21.0 Introduction.

Several problems concerning syntactic activities here arise because of past difficulties in separating descriptive from syntactic elements in logic. Points made by various authors are discussed or given reference.

Carnap and others have claimed that a difference between syntactic and descriptive elements can not be established, but this outlook will be repudiated. A statement of the difference can be drawn from Carnap's basic view of the nature of syntax quoted in 21.2, and from a similar view in the article "Axiomatic Syntax" by F.W. Harwood.¹

Although it will be seen that Carnap nevertheless differs in what he accepts as syntactic and logical, the basic statement can be used to correct him. In this regard "Introduction to Semantics",² "Meaning and Necessity",³ and "Foundations of Logic and Mathematics"⁴ will enter as references.

As a result of establishing a difference between syntactical and descriptive elements, it will be seen that the terms syntax and logic (in the usual sense) can not be identified as they are in L.S.

If they are, then, as various authors have claimed, the distinction between what is syntactic and what descriptive is confused.

The nature of logical or syntactic variables, as well as logical or syntactic constants is treated, and Carnap's "universal words" are discussed. Here again, disagreements with him are recorded concerning the last, and special reference is made to his remarks concerning their use in natural language.

A short clarification of our standing on the claims of the "linguistic thesis" in logic is made, and a reference to the place of statistical studies in finding syntactic elements ends the chapter.

21.1 Syntactic and Semantic Difference; Universal Words.

21.11 Criticism about Carnap's distinction of the syntactical and analytic from the synthetic or descriptive, has arisen from the fact that he permits descriptive primitive sentences or physical laws to occur as part of the transformation rules of a language. (L.S. p.186, "Problems of Analysis" by Max Black,⁵ p.275).

Nevertheless, if it is insisted that an analytic sentence concerns only the positional arrangements of symbols, and that any descriptive sentence uses values of a positional (i.e. syntactical) class of symbols, not symbols for that positional class itself, the distinction may be retained. If a descriptive primitive sentence or term is so introduced into the transformation rules of a language

that it requires for its expression only the names or symbols for syntactic classes or constants, then only can it be considered analytic. Otherwise it must be considered a full or partial interpretation.

For example, when in "Foundations of Logic and Mathematics"⁴ the law of thermic expansion is introduced (p.36), we see at once that it expresses values of argument and predicate variables already established, and that it makes these values a constant feature of the transformation rules. As such, they provide an interpretation for analytic sentences, and the law of thermic expansion is still fundamentally descriptive or synthetic. The same is true for other cases where Carnap introduces physical laws or terms in applications of logical calculi. (Examine L.S.pp.178-9 where a physical law because it is general is considered logical, but is not truly so in English.)

21.12 Various statements by Carnap support the claims of 21.11. (See e.g. L.S. p.28, p.111, p.182). For instance, in "Foundations"(p.16-p.17) there is a theory put forward that a formally determinate or logical syntactic sentence, and so also an analytic one, is concerned only with the arrangements of symbols and not with their designata. When designata are considered, there is study of sentences on the descriptive level. And so for a logical syntactic sentence we have to use only logical terms, not descriptive ones.

Once the view of the present paper is taken that all logical terms are established by study of the positional arrangements of all the descriptive terms of a given language, then some necessary ideas follow.

It is obvious that on the syntactic level a logical constant is an autonomous symbol still capable of retaining its descriptive value. So in "Foundations" we see that the rules of formation for a semantical system $B - S$ of a given language (p.8), are the same as those for a syntactical system $B - C$ of that same language. (p.18). It can be held that in the constants we have a unification of two aspects of a language. In any syntactic system and therefore in an analytic sentence there will be a certain amount of descriptive content which may be studied or ignored according to convenience, and in any semantic system there will be syntactic content which may be treated in the same way.

This last is true, because for example, a descriptive content may be provided for the class variables also, although this does not in any way alter their syntactic nature, nor make the possibility of study of the positional arrangement of the signs of a language, and so of analyticity, impossible to separate from descriptive and synthetic study.

21.13 The view of logical variables (i.e. syntactic classes) which follows from the definition of syntax in this paper, can be linked directly with statements made by Carnap. (L.S. p.169-p.170, p.181, p.190). But one of the unacceptable features of his work is the inclusion of physical laws (in determinate sentences L.S. p.178, and in transformation rules L.S. p.190) for their establishment.

However, despite the fact that Carnap withdraws himself in "Introduction to Semantics"² (p.247) from remarks in the section of L.S. on general syntax, the definition of a genus there (pp.169-70) is of considerable importance and may be compared with the definition of a syntactic class given earlier. It must be clear however, that the values of the class or genus ~~form~~ sentences which may be semantic nonsense but which are formally valid.

21.14 The descriptive content of a syntactic variable mentioned above can be expressed in a universal word. (L.S. p.292 foll.) Carnap's comments upon universal words show similarity with views in the last two paragraphs of 21.12. For example, thing is a universal word if it is a predicate of a genus, that is, of a collection of terms which all have the same syntactic occurrences.

As "thing" names this class of terms, any one of its values will include this meaning. Thus on the one hand we have the purely positional analysis of elements into syntactic classes, and on the other

the establishment of a meaning term for all the values of any class. The inclusion of the meaning term in a system of transformation rules does not alter or even bear upon the positional or analytic nature of the system.

The meaning term for a variable, or for a constant, is part of the syntax of a language as well as of its descriptive interpretation. In previous studies of the syntax of English, for instance those made by Jespersen, there have been attempts to use universal words as a means of establishing features of syntax. However, the meanings provided have not always been accurate, and a more precise definition of the syntax of a language, which can lead to statements of syntactic meaning, comes through positional analysis.

Carnap himself is aware of difficulties in stating the universal words of a word language.

"Since the rules of syntax of the word-language are not exactly established, and since linguistic usage varies considerably on just this point of the generic classification of words, our examples of universal words must always be given with the reservation that they are valid only for one particular use of language." (L.S. p.293).

However, it is not impossible for these difficulties to be cleared up. For example, thing will not apply to all n, only to most. It may be that singular and plural countable is a more

comprehensive meaning property for the class, though there are still some n which will not take is (the mass nouns like honesty, sleep, etc.) and others which never occur in the singular (words like economics, physics, rhythmics, etc.). These, nevertheless, could be classified separately.

21.15 The universal words have to be kept distinguished from the semantic values of variables. For example, if thing were a generic term in any language the following would be true. In the sentence Caro is a thing "L - content is null and it is analytic. If in Caro is a thing, Caro is replaced by any other thing - designation, the result is again an analytic sentence; but if Caro is replaced by an expression which is not a thing - designation, the result is not a sentence at all." (L.S. p. 293). And it may be added, if thing is replaced by any thing - designation, the result is not an analytic sentence but a descriptive one.

All this ^{is} true, nevertheless, only if thing is generic. In this case it is not, for although Colour is a thing is a false sentence, it is one which is permitted by the syntactic formation rules. The generic term must apply to all values of a syntactic class.

The introduction of universal words into a syntactic system is comparable to the introduction of P-rules, except that a P-rule need not necessarily refer to a genus, but may provide for example particular values of logical variables as constant features. (For example the law of thermic expansion as before. "Foundations of Logic and Mathematics," p. 36).

21.16 Carnap says that in natural language

"We all use such universal words in our writings in almost every sentence, especially in the logic of science. That the use of these words is necessary is, however, only due to the deficiencies of the word languages, i.e. - to their inadequate syntactic structure. Every language can be transformed in such a way that universal words no longer occur in it, and this without any sacrifice either of expressiveness or conciseness." (L.S. p.294).

But why may we not claim the same for word languages, and take exception to the statement that their syntactic structures are inadequate. And in the full description of the syntax of any language the universal words will still be needed. That English may use these syntactical universal words as part of its object language proves nothing about the inadequacy of its syntactic structure.

21.17 Carnap goes on to write about the uses of universal words. The one to be discussed here is as an auxiliary grammatical symbol, which is held to be sometimes necessary in a word language to determine univocally the syntactical genus of an expression and sometimes not. "Examples: 1. By means of the process of crystallization Since crystallization belongs without any ambiguity to the genus of the process, one might simply say: By means of crystallization Similarly with the following examples.

2. The condition of fatigue 3. The number five"(L.S.p.294).

However, this view can not be considered correct because process does not name a syntactic genus in English, although it might in a scientific language of some sort.

"In the following sentences the universal word is necessary for univocality. It can be rendered superfluous by the use of a suffix ('7' and '7r') or by introducing various explicit expressions in place of the ambiguous one. 4a. The integer y 4b. The real number y 5a. The condition of friendship 5b. The relation of friendship"(L.S.p.294).

Whether these examples supply true universal words or not, it may be said that universal words are no more necessary here than they are for the interpretation of the symbols of any syntactic calculus whose application is unknown. Until the interpretation is clear, ambiguity holds.

Carnap next attempts to show the necessity of universal words as auxiliary symbols for variables in the universal and existential sentences of a natural language.

"The word-language employs as variables words (a, some, every, all, any, and so on) to which no particular genus is correlated in their realm of values. If, as is usual in the symbolic languages, different kinds of variables were used for the different genera of substitution - values, the addition of a universal word would be superfluous. Accordingly, the

universal word here serves to some extent as an index to a variable which indicates the genus of its substitution values."

"Examples: We will contrast the formulations of the word - language with those of the symbolic language of logistics. 6a. If any number...., then.... 6b. (x) (.... \supset) (where 'x' is a g). 7a. There is a number.... 7b. (\exists x) (.....) (where 'x' is a g). 8a. I know a thing which 8b. (\exists x) (.....) (where 'x' is a thing - variable)."

Firstly, the words any, a, all, some etc. are not variables themselves, but individual object language terms which indicate semantically that a semantic variable and not a logical one follows. Syntactically, they are either constants or values of small syntactic classes. Since Carnap does not apply a positional analysis to the natural language, he does not realize that if these words are called variables, then so must be the symbols (,), \exists and K. (Compare Quine: "Mathematical Logic", p.5⁶, for similar error about pronouns).

The words given are all capable of occupying a particular position in a sequence such as - n v n, and consequently may be classed together and perhaps called "quantifiers." (It is to be remembered however that such a class may include more than one syntactic element.) What they quantify on any occasion - objects

such as tables, plants, atoms, or various groups of numbers - does not limit their own syntactic meaning nature.

In summary then, the necessity for universal words as auxiliary grammatical symbols in English is not established.

21.2 Differences between Present Theory and other Authors.

21.21 It has become evident that our views of syntax and logic, and thus of logical symbols as opposed to descriptive ones, are different to those of Carnap. They can be developed from the core of some statements he makes in L.S., and two of them should be quoted.

(1) "The syntax of a languageis concerned, in general, with the structures of possible serial orders (of a definite kind) of any elements whatsoever." (p.6).

(2) ".....we must take the general replaceability of the 2/ as the definitive characteristics of the L- rules." (p.181).

(See also L.S.pp.169-70, p.233, and "Introduction to Semantics", pp9-10).

But he himself does not develop these ideas in the way we have done, and takes views which are expressed in his later works.

("Introduction to Semantics", pp.56-59, "Meaning and Necessity", p.85 foll.)

Syntax has been identified with logic in this paper, as in Carnap's earlier work, L.S., but even so a difference has been noticed. (21.11, 21.13, 21.14). Moreover, logic for Carnap concerns not only

syntactic symbols, but various individual terms (or variables) which may or may not be positional constants (or positional variables) in a given language. (L.S. p.178, "Introduction to Semantics", p.57, "Meaning and Necessity", p.86). This is a usual interpretation of what logic covers, and so we hold that syntax should not be linked with it in such a broad sense, even when semantical rules are included as Carnap recommends. (See "Introduction to Semantics, p.161, p.246. See also "Problems of Analysis" by Max Black, p.255 foll. on "Carnap on Semantics and Logic.")

Although we have identified syntax with logic, this logic is necessarily different, and consequently it might be more convenient if its kind were given a different name. However, until the syntactic thesis has been found useful by others, it would appear unwarranted.

21.22 The differences in outlook upon logical and descriptive symbols are of crucial importance. Carnap maintains that no general distinction between the two kinds of signs is known, and that for each language the logical symbols must be listed and opposed to the descriptive ones. ("Introduction to Semantics", p.59) We on the other hand state that a logical sign is a syntactic one in the sense of 4.31. We define as logical any symbol which represents a class of elements (which may be a class with one member and thus a constant)

which all have one or more positional features in common in order to create a sentence. The syntax of the language is thus distinct from its semantics.

Consequently it is not agreed that the sentential connectives, signs of the universal operator (Carnap illustrates with for every), the signs ⊂ and is a, parentheses and commas etc. are necessarily logical in the given languages of "Introduction to Semantics", p.57. Some are certainly not in English, and it may be that the universal and existential operators are members of a small class in symbolic logic languages.

Nor is it agreed that

"Further, all those signs are regarded as logical which are definable by those mentioned; hence, e.g. the sign of the existential operator (' \exists ' or 'for some'), signs for universal and null classes of all types, the sign of identify ('=', 'is the same as') all signs of the system of Princ. Math. by Whitehead & Russell and of nearly all other systems of symbolic logic, all signs of mathematics (including arithmetic, analysis of real numbers, infinitesimal calculus, but not geometry) with the meaning they have when applied in science, all logical modalities (e.g., Lewis' strict implication)." (L.S.p.58).

It is hard to understand why all the signs of mathematics are kept as logical signs, unless an historically conceived idea of what

constitutes logic is the reason. For even within the language of mathematics not all of its signs are syntactical.

21.23 The previous views also enable a distinction to be made between a logical and a descriptive variable (Cp.21.13). Carnap considered the whole question of whether variables were logical or descriptive in need of further study. ("Introduction to Semantics", p.59). But it is obvious now that a number of descriptive variables may be sub-classes of a logical variable. In addition the variables of a co-ordinate language are not all logical as claimed by Carnap in "Meaning and Necessity" (p.86).

In English for example n v and a are logical variables. But all tables, chairs, towns, colour adjectives, shape adjectives and etc. are descriptive values grouped into classes. When Quine for instance says any statement of the form If every - is - and - is a - then - is - is logically true, and we construct If every man is mortal and Socrates is a man then Socrates is mortal, man and mortal are not logical terms. So if we agree with him that the second sentence is logical, then it can be seen that what are called analytic sentences of customary logic using the universal and existential operators do not necessarily contain only logical terms. (See "Mathematical Logic", pp. 1, 28, 55). The sentence with blanks also may not be a logical one in the strict syntactic sense, but can

be accepted to illustrate the point. It should also be corrected to

If every $\frac{-}{1}$ is $\frac{-}{2}$ and $\frac{-}{3}$ is a $\frac{-}{1}$ then $\frac{-}{3}$ is $\frac{-}{2}$)

Compare with the above, L.S. p.2 - p.3, where the meaning type of individual words has to be known, and where we would replace sentences using such descriptive variables by formulas of the kind

$$(a) \frac{n+s}{1} \quad \frac{v+o}{1} \quad \frac{a+ly}{1}$$

$$(b) \frac{\bar{n}+o}{2} \quad \frac{v+s}{1} \quad \frac{a+y}{1}$$

$$(c) \frac{\bar{n}+o}{2} \quad \text{is} \quad a \quad \frac{n+o}{1}$$

Such a deduction would not be valid if $\frac{\bar{n}}{2}$ was not of the same type as $\frac{n}{1}$; for example if $\frac{\bar{n}}{2}$ is the name of a dog and $\frac{n}{1}$ stands for men.

The basic ideas of this section can be extracted from a remark made by Carnap ("Introduction to Semantics", p.44), despite his views elsewhere.

"If a system S is to contain variables, the classification of signs, which precedes the formulation of rules, has to specify the kinds of variables. The rules of formation refer to these kinds in describing the forms of sentences. Then, in a rule of values related to the rules of designation, it is stated for each kind of variable which entities are to be values of the variables of that kind.

Their class is sometimes called the range of values of the variables in question."

If the rules of formation concern only positional arrangement then the logical variables are determined. Their values can also be given through study of the positional uses of identified elements and without a knowledge of the rules of their designation. (Compare Harris on the distributional classification of morphemes.)

21.24 If the distinction between logical and descriptive signs is, as Carnap suggests, the basis for the distinction between logical and semantic truth ("Introduction to Semantics", p.vii), then it can be seen that Tarski's view that the boundary line between the last two concepts is arbitrary is not correct for our senses of logical and syntactic. (See ^{also} "Introduction to Semantics", p.87). However his views are right in the normal languages of symbolic logic. Thus since Carnap includes non-syntactic elements in his logic, we can understand his stress upon semantics in a sense different to the one he meant. "The view will here be explained that logic is a special branch of semantics, that logical deducibility and logical truth are semantical concepts." ("Introduction to Semantics", p.56).

21.25 Black in "Problems of Analysis" maintains that Carnap's more recent linguistic thesis about logic expressed in the last quotation and evident in other passages in "Introduction to Semantics" (See "Problems of Analysis", p.260) can not be upheld, for the later

semantic approach involves the same procedures as those in the earlier syntactic one, i.e. the study of typographical relations. ("Problems of Analysis", p.287).

If this is true, and we are inclined to think so, then the views of 21.21 have to be accepted and while it may be held that Black, Quine, and Tarski are correct in their opinion that there exists no clear cut difference between logical and descriptive statements as given in the languages of symbolic logic, it is incorrect to say that a distinction could not be made between them. (Cp. also Chomsky and Barhillel⁷).

Once the syntax or structure of a language has been worked out it is quite possible to hold various descriptive values constant in order to make various deductions. This happens in symbolic logic, for example in the illustration from Quine above and in sentence (2) No bachelor is married in Quine's article "Two Dogmas of Empiricism."⁸

Deduction still depends on the syntax of the sentences involved but it now includes specific values of the structural elements and is consequently no longer purely syntactic. Thus in other sentences implies and or might be descriptive, or else they might be autonymous logical symbols, retaining their meaning. In either case deductions using them involve study of typographical relations, i.e. of the structure of the sentences involved. (Contrast Black, "Problems of Analysis", p.271 and p.272.)

Such considerations are very important in assessing the merit of Black's remarks ("Problems of Analysis", p.273-p.275), when he uses My pencil cannot be red unless it is coloured as an example of a logical sentence. It is not a purely logical sentence at all. The logical sentence would be

m³ n+o is not a+o x it is v+d

(x stands for either a syntactic class or else a syntactic constant as the case may be).

So we find his following claims, that all sentences are involved when logic is said to consist of sentences in certain formal relations, to be inaccurate. (Cp. 22.23). A point of view similar to the one upheld here, also enables us to define what formality is accepted as involving logical truth, and so to get rid of the confusions Black refers to. ("Problems of Analysis", p.276-p.277).

21.26 Although syntactic logic thus supports a linguistic thesis for logic, it is certainly not considered that the answer to the question of the nature of logic as deductive reasoning is by any means given. Like Black we "cannot help feeling that if all users of the English language except one were taught to assert that N could be true while P or ~N was false, they would be wrong and he though in a minority of one, still right." ("Problems of Analysis", p.277).

But we can still recognize that

$\bar{n}+o$	is	t^{sg}	a+o	$n^{x}+er$	>	$\bar{n}+o$	v+o	a+ly
1			1			1		1

(where \underline{n}^x indicates the verb of the right side of the implication changed into a corresponding noun) is referentially or empirically true, and that it involves a purely linguistic deduction which may or may not be valid in another language. Thus in contrast with Black ("Problems of Analysis", p.278-p.279), it can be said that there is a social convention here in what follows necessarily. We have a social tool.

However, English and other language users do not in fact engage in such contradictions as the one Black points out, and it is clear that any language system includes extra - linguistic knowledge. This can occur in the syntax as well as in the semantics, and so in syntactic primitive sentences as well as in semantic interpretations of them. Knowledge does not result just from a linguistic mechanism, but from extra mechanistic information with which it works.

21.27 It seems likely that while some may consider the formalized structure of a language to consist only of its syntax, others may consider that a statistical assessment of the frequency of occurrence of symbols, whether they are values of a variable or not, may lead to the retention of these symbols as constants if their frequency is high. Very frequently occurring symbols could be incorporated into an analysis of the structure of English, since they are used so much in sentence structures. This has been pointed out to me by Mr. F.W. Harwood.

However, even though this would support Tarski's view, it is

felt that the difference between syntax and semantics outlined above still needs to be retained.

- ¹ Harwood, F.W., "Axiomatic Syntax", Language, 31 (1955), pages 409 - 413.
- ² Carnap, Rudolf, Introduction to Semantics, (Cambridge, Mass., Harvard University Press, 1942).
- ³ Carnap, Rudolf, Meaning and Necessity, (Chicago, University of Chicago Press, 1947).
- ⁴ Carnap, Rudolf, Foundations of Logic and Mathematics, International Encyclopaedia of Unified Science, Vol. I, No. 3, (Chicago, The University of Chicago Press, 1939).
- ⁵ Black, Max, Problems of Analysis, (London, Routledge and Kegan Paul, 1954).
- ⁶ Quine, W.V.O., Mathematical Logic, (Cambridge, Mass., Harvard University Press, 1951).
- ⁷
 - (a) See the article named in 8 below.
 - (b) See 5 above, for the essay "Carnap on Semantics and Logic."
 - (c) Compare also these articles by linguists: Bar-Hillel, Y., "Logical Syntax and Semantics", Language, 30 (1954), p.230 foll.
Chomsky, N., "Logical Syntax and Semantics," Language, 31 (1955), p.36 foll.
- ⁸ Quine, W.V.O., "Two Dogmas of Empiricism", The Philosophical Review, 60 (1951), p.23, sentence (2). (This article is reprinted in Quine's From a Logical Point of View, (Cambridge, Mass., Harvard University Press, 1953).

CHAPTER 22.

MORE ON SYNTAX, LOGIC, AND SEMANTIC MATERIAL.

22.0 Introduction.

This section amplifies the view of Chapter 21 that syntax and logic can not be identified as they are by Carnap in L.S. However, claims for the establishment of a correct linking of the terms are made. It is said that logic is the study of syntactic sequences in any given language, by means of certain selected semantic concepts such as equivalence and implication, either using or not using the descriptive interpretations of the syntactic or logical elements - as desired. (See 22.11)

It will be considered sufficient if such a claim is merely recognized in this paper, because, until it is accepted by others as correct, it is convenient to use syntactic and logical as equivalent adjectives when describing elements etc. Nevertheless, it is felt that a separation will have to be made. (See 22.12)

Some time is spent in discussing the concepts of equivalence and implication to show that they vary in interpretation.

Interpretations will be established for studies in English syntax.

The uses of semantic as well as syntactic transformation rules are then treated. Descriptive (i.e. semantic) constants are described, and lead on to remarks on the introduction of empiric

laws into the syntactic system. It is suggested that new kinds of deductive calculi could be developed.

The previous discussion of transformation rules will show that Carnap can not uphold the claim that the transformation rules of a language provide its logical symbols. (L.S. P.168-p.169). They can be established from the formation rules above.

22.1 Relation between Logic and Syntax.

22.11 It has already been suggested that the identification of syntax with logic may not be useful.

Black for example differentiates logic from grammar (i.e. syntax in this paper) and says that it deals with different materials and different relations:

"When the materials are propositions or the elements out of which propositions are made, and the relations are those that determine conditional truth and falsity, we have a case of logical form." ("Critical Thinking"¹ p.47; see also p.51).

But the difficulty is that logical form continually exhibits a relationship with syntactic form and thus invites the outright linking of the two. An obvious case where the relationship is evident is Carnap's "Logical Syntax of Language", and in Black's own work, "Critical Thinking", pages 49, 51, and 116 - 117 may be noted. In addition, discussions on whether there is a difference between logical and descriptive elements bring up the question of

similarity again. (Consider e.g. Black's article "Carnap on Semantics and Logic."²)

If, however, Black's definitions of logic are accepted, other ideas must enter. Since "logical form consists of relations involving truth and falsity" (C.T. p.51), since "Logic is a study of reasoning" (C.T. p.9) and since "Reasoning is an attempt to pass from certain items of information (or 'supposed truths') to others for which they are evidence" (C.T. p.9), syntax can not be said to constitute logic.

For while it is an essential part of logic - for example knowledge of syntax is required in the examples of descriptive universal and existential statements above - the means by which logic proceeds is by special semantic concepts such as equivalence and implication operating on syntactic and non-syntactic material alike. Signs for these and other special semantic concepts need not be syntactic in a language, and so if we limit logic to syntax, then deduction using them is impossible.

22.12 As a result of all these considerations, we could define logic as being the study of syntactic sequences in any given language, by means of certain semantic concepts such as equivalence and implication, either using or not using the descriptive interpretations of the syntactic or logical elements as desired . (If equivalence and implication concepts occur in a language as

syntactic constants then they are still autonomously semantic.)

This allows for the introduction of semantic deduction in the transformation rules while stressing the need for basic syntactic knowledge. It also allows for the view that when logic uses only syntactic form on which to operate with its special transformation concepts, as in

$$\frac{\bar{n}+o \quad \text{is} \quad t \quad a+o \quad n+er \quad \bar{n}+o \quad v+s \quad a+ly}{1 \quad \quad \quad 1 \quad \quad \quad 1 \quad \quad \quad 1}$$

then this activity should be differentiated from that when not only syntactic material is used. It will be felt sufficient if this difference is recognized, and the linking of syntax with logic could be discarded.

22.2 Syntactic Transformations: Equivalence.

22.21 Special attention needs to be given to transformation rules in a logical system, although they have so far been considered little. The concepts of equivalence and implication here become crucial, for it will be seen that they are to be defined in relation to other concepts in any instance of their use, and that treatment of them as absolute is inadequate. If their definitions vary, then so do the transformation rules, and thus so does the concept of analyticity. It can be said that what satisfies the concept of analyticity varies from one language to another.

22.22 We may begin by discussing the variant nature of equivalence and then proceed to implication. For example on the empiric or

semantic and not the purely syntactic level, a man and an animal may be defined equivalent or non-equivalent in relation to strength. And again, on the same level, equivalences could deal with meaning types as in 21.23, or general empiric laws.

None of these sentences would be analytic for us because none of them is purely syntactic. But granted the syntactic nature of the sentences with which the equivalence sign works, and thus its different nature in this case, it can still vary in meaning.

The equivalence rules of a language can then concern what positional re-arrangements of syntactic elements will provide one true (or false) sentence from another, as in the propositional calculus, when a sentence of any form and any semantic content is defined equivalent to another of any form and any semantic content when they are both true (or both false). (See Lewis and Langford, p.79 foll.³) In another language they might concern only the deduction of a true sentence from another whose truth or falsity is immaterial. (See Carnap's L.S. p.20 $\frac{p}{1} \supset (\frac{p}{1} \vee \frac{p}{2})$). In another, they might even concern what true sentences result from sentences which are true only in one half of their values, or one third, etc. (Compare Reichenbach E. p.180).

Similarly, on the syntactic level, two sentences may be defined equivalent when their forms provide the same empiric, semantic,

or referential content, as in some of the formulas of the calculus of simple functions.

$$\text{E.g. } (x) \overline{f(x) \cdot g(x)} = (x) \overline{f(x)} \cdot (x) \overline{g(x)}$$

A similar kind of equivalence was shown in 19.31 for

$$\frac{-G_1 \vee G_2}{1 \quad 2} = \frac{G_1 \supset G_2}{1 \quad 2}.$$

In English an example occurs in

$$\frac{\overline{n}to \quad v+d \quad t^{sg} \quad nto \quad to \quad \overline{n}to}{1 \quad 1 \quad 1 \quad 1 \quad 2} \quad \frac{\overline{n}to \quad v+d \quad \overline{n}to \quad t^{sg} \quad nto}{1 \quad 1 \quad 2 \quad 1 \quad 1}$$

(The verb class is a small syntactic one including give, but is left unspecified). The truth or falsity of either sentence is of no primary concern. If one is false then the other will be also. In other cases there may be the possibility of the sentence being sometimes false. This will also be unimportant. For example in

$$\frac{t^{pl} \quad nts \quad are) \quad v+ing \quad a+ly}{1 \quad 1 \quad 1 \quad 1} = \frac{t \quad nts \quad are) \quad a+ly \quad v+ing}{1 \quad 1 \quad 1 \quad 1}$$

Consequently it is seen that there will be different kinds of logic for the one syntax. It is also obvious that what satisfies the concept of analyticity will vary, even though it is limited to syntactic material. This however does not deny that an analytic sentence can be separated from a syntactic or descriptive one, despite the contrary views of such logicians as Quine and Black. (Compare also Chomsky). The syntactic restriction ensures the difference.⁴

22.23 The kind of equivalence transformation rule which will be adequate in syntactic studies of English and other natural languages needs to be defined. There seems little value for present purposes in the kind taken from the propositional calculus. It would apply to the syntax of any language so long as true and false sentences occurred in it.

What seems useful is the definition of equivalence which will concern any two syntactic sentences so that truth or falsity is immaterial, but so that both have the same referential content. However, to ensure restriction of the equivalence to syntax, and to prevent the introduction of semantic material, further stipulation is needed. We want to be able to separate

The man found the young dog

= The male human discovered the puppy (a semantic equivalence)

from The man found the young dog

= The young dog was found by the man (a syntactic equivalence).

A stipulation ensuring such a distinction concerns not only equivalence but all transformation rules.

22.24 Consequently it is stated that in any case of a syntactic transformation, a given value of a logical variable in one sentence must also occur in the other. The mention of values of variables does not alter the syntactic nature of the transformation, for the value need not be specified. All that is insisted, is that

since a value of a variable occurs in one sentence, then this same value is to occur in the other. This ensures a purely structural change of sentences.

The logical constants can vary, i.e. they can occur in one sentence but not in the others, whereas the descriptive constants can not. Thus in the illustration in 22.23, by is a logical constant, but young is descriptive. The syntactic transformation can be expressed in this manner

$$\begin{array}{cccccc}
 & \text{sg} & & & \text{sg} & \\
 \text{t} & \text{n+o} & \text{v+d} & \text{t} & \text{a+o} & \text{n+o} \\
 \hline
 1 & 1 & 1 & 1 & 1 & 2
 \end{array}$$

$$= \begin{array}{ccccccc}
 & \text{sg} & & & & & \text{sg} \\
 \text{t} & \text{a+o} & \text{n+o} & \text{was} & \text{v+o} & \text{by} & \text{t} & \text{n+o} \\
 \hline
 1 & 1 & 2 & & 1 & & 1 & 1
 \end{array}$$

But where there is no ambiguity in identity of values, the numerals may be dropped as in

$$\begin{array}{cccccc}
 \text{t} & \text{n+o} & \text{v+d} & \text{t} & \text{a+o} & \text{n+o} & \text{etc.} \\
 \hline
 & 1 & & & & 2 &
 \end{array}$$

22.25 The only non-syntactic information that enters these transformations of equivalence and implication is that the users of the language are agreed that the first sentences do contain the same referential (or empiric, factually verifiable) information as the second, or else that the first sentences allow an implication which is referentially true from the first. If one side is false then the other will be also, and if one is true then the other is also,

concerning any referential or empiric data which may fill the variables. They are therefore analytic, since an analytic sentence is defined as one which is always true independent of empiric investigation about truth or falsity. (See Reichenbach E. p.36).

22.3 Relations between Syntactic and Semantic Transformations.

22.31 These purely linguistic transformations, of which there are a large quantity, could reduce the number of formation rules we need establish for a machine to handle referential material. For example take

$$\begin{array}{l}
 \begin{array}{ccccccc}
 & \text{th} & & 1 & & & \\
 \text{n} & +\text{o} & \text{m} & \text{v+d} & \text{t} & \text{n+o} & \text{to} & \text{t} & \text{n+s} \\
 & & & & 1 & & & 2 &
 \end{array} \\
 = \begin{array}{ccccccc}
 & 1 & & & & & \text{th} \\
 \text{m} & \text{v+d} & \text{t} & \text{n+o} & \text{to} & \text{t} & \text{n+s} & \text{n} & +\text{o} \\
 & & & 1 & & & 2 & &
 \end{array} \\
 = \begin{array}{ccccccc}
 & 1 & & \text{th} & & & \\
 \text{m} & \text{n} & +\text{o} & \text{v+d} & \text{t} & \text{n+o} & \text{to} & \text{t} & \text{n+s} \\
 & & & & 1 & & & 2 &
 \end{array} \\
 = \text{etc.}
 \end{array}$$

and interpret the first sentence as Yesterday he gave the book to the children.

Here, only one of the forms which are all equivalent is required to convey the referential material they contain, and formation rules for the others may be dismissed. The purely linguistic transformation rules need never occur in a machine system at all. However, if the machine is to formalize any given text of a

language where formal equivalences occur, they will be necessary in order to interpret the text and deduce logically from it.

Deduction, however, will also proceed through semantic transformations, and for the first type of machine handling where no given text is formalized, it would be the only kind.

We could begin by holding certain values of a small logical class constant and subdivide for example the nouns, according to which one of the constant values they could combine with. (Individual prepositions could break up nouns in this way.) The practice could be extended and more and more of the small classes could be held constant in order to manipulate the members of the large classes.

22.32 Considering the frequency of usage found by Thorndyke-Lorge,⁵ Fries, and others for the members of the small classes, it may be most convenient to do so. It may also be considered that as constants with high frequency, subdividing the nouns, verbs, adjectives, and etc. according to their meaning, they should be treated as part of the syntax of the language.

But there is a desire to retain the definition of syntax given, because of the value of a purely positional analysis of a language in providing possibilities of formalization, and because of the gauge which it provides for understanding the nature of an analysis of a language. The artificial languages, for instance, provide cases where the nature of their logic is obscure.

If a member of a small class in English is held constant it will be called a descriptive constant. Thus if words like all and some are held as descriptive constants, it can be seen that transformation rules for English formulas can be developed which will be like those of the calculus of simple functions.

22.33 Many other kinds of calculi using descriptive constants could be developed also. Empiric laws could be introduced by holding sub-classes of the large variable classes constant; for example words for dogs, animals, men, tables etc. Deductions could be made from Iron is heavier than water, and so on.

As it is a feature of some small classes that if members are held constant, various manipulations with the large class syntactic variables, or values of them, can be performed, new kinds of calculi could develop. Consider the prepositions and the quantifiers as well as the conjunctions. New relationships between semantic variables could be expressed and deduction proceed. Specific items of information could also be held constant in a transformation rule of the kind The man in the garden . the man who lives next door. (Compare Carnap's descriptive concrete sentences, L.S. p.316).

22.34 It can now be clearly seen that the transformation rules of a language do not necessarily distinguish its logical constants. (Compare Carnap L.S. p.168). Members of small logical classes may be held constant to form certain transforms.

All the logical constants of a language can be established through study of its formation rules, through study of the distribution of the elements and without any knowledge of what sentence forms are equivalent to others, i.e., without any knowledge of what forms provide the same meaning equivalences. This has become evident in previous examples. (See also 7.4). Consequently we disagree with Carnap (L.S. p.163-p.169), when he says that the transformation rules of a language provide us with its logical symbols.

22.4 Syntactic Transformations: Implication.

As we have shown for equivalence, the definition of implication can also be shown to be not absolute, but definable in relation to other concepts. Logicians distinguish material and strict implication for instance.

It becomes necessary to define for English what sort of implication will be used in stating the transformation rules of a purely syntactic kind. On the analogy of the rule of substitution RI I (L.S. p.32) the following could be accepted.

$$\begin{array}{c}
 \begin{array}{ccccccc}
 & & & & n+o &) \\
 & & & & a+o &) \\
 t & n+o & v+s & a+o & \supset & t & v+ing) & n+o & v+s & a+o
 \end{array} \\
 \\
 \begin{array}{ccccccc}
 & & n+s &) & v+ing) \\
 & & n+o &) & \\
 & & a+o &) & a+o &) \\
 \supset & t & v+ing) & n+o &) & n+o & v+s & a+o & \text{etc.}
 \end{array}
 \end{array}$$

Such a rule could replace formation rules. However for purposes of deduction the concept of implication which concerns referential content needs to be set up.

For example n+s v+o a+ly might always imply t^{sg} n+o v+s a+ly. Gazelles run quickly A gazelle runs quickly where both sentences are true, and Gazelles run slowly A gazelle runs slowly where both are false.

Further inquiry into the use of the implication sign in the purely syntactic transformations of English is needed.

It might be found that the change of some active forms into passive ones should be expressed as implications and not as equivalences, because although (in

t	n+o	was	v+n	(with	t	n+s
1					2	

shows the same logical form for the three prepositions, The man was hit in the eyes does not take the active conversion The eyes hit the man. Thus an active form of the kind t n+s v+d t n+o only implies the passive, for the passive does not always imply the active and thus prevents equivalence.

On the other hand it may well be that in can not be called the same logical element as with and by because of its different occurrence in other sentences. The same might be true of with in relation to in and by. A syntactic equivalence could then be stated

for the active - passive conversions using only by. For instance proper - names in those conversions where by occurs, always seem to hold as in

$$\frac{\bar{n}+o}{1} \quad v+is \quad \frac{\bar{n}+o}{2} \quad \frac{\bar{n}+o}{2} \quad is \quad v+n \quad by \quad \frac{\bar{n}+o}{1}$$

There is freedom of course to introduce implications which rest upon semantics (or strict empiric laws if desired), as well as upon syntactic structure. These are descriptive implications. For example

$$\begin{array}{l} \underline{\text{All men are mortal}} \\ \underline{\text{Socrates is a man}} \end{array} \left. \vphantom{\begin{array}{l} \underline{\text{All men are mortal}} \\ \underline{\text{Socrates is a man}} \end{array}} \right) \supset \underline{\text{Socrates is mortal}}$$

Both of the left hand sentences must be true for the right hand one to be correct. If one on the left hand is false, then the right will be also. If all turns out to be a logical constant, and if all the descriptive values of those sentences are eliminated, then the syntactic or logical rule on which this instance of implication rests can be expressed.

$$\begin{array}{l} \frac{\text{All} \quad n+s \quad \text{are} \quad a+o}{1} \\ \frac{\bar{n}+o \quad is \quad t^{53} \quad n+o}{2} \end{array} \left. \vphantom{\begin{array}{l} \frac{\text{All} \quad n+s \quad \text{are} \quad a+o}{1} \\ \frac{\bar{n}+o \quad is \quad t^{53} \quad n+o}{2} \end{array}} \right) \supset \frac{\bar{n}+o \quad is \quad a+o}{2}$$

(Gp. 21.23)

- ¹ Black, Max, Critical Thinking (2nd ed., New York, Prentice-Hall, 1952). This will be referred to by C.T.
- ² Black, Max, Problems of Analysis, (London, Routledge and Kegan Paul, 1954).
- ³ Lewis, C.I., and Langford, C.H., Symbolic Logic (New York, The Century Co., 1932).
- ⁴ (a) Quine, W.V.O. "Two Dogmas of Empiricism", The Philosophical Review, 60 (1951).
(b) Black, Max, Problems of Analysis, (London, Routledge and Kegan Paul, 1954): the essay "Carnap on Semantics and Logic."
(c) Chomsky, N., "Logical Syntax and Language", Language, 31 (1955) p.36 foll.
- ⁵ Thorndike, E.L., and Lorge, I., The Teacher's Word Book of 30,000 Words (New York, Bureau of Publications, Teacher's College, Columbia University, 1944).

CHAPTER 23.PRESENTATION AND USE OF ENGLISH SYNTAX.23.0 Introduction.

The point has been reached where it is possible to give a few concluding ideas about the presentation and use of English syntax. More statistical and factual knowledge is required than possessed at present in order to state what language material is exactly included, but it is hoped that the following remarks will provide some basis for development.

Stress throughout the paper has been upon theoretical problems whose settlement will allow the accumulation of empiric data in the language to follow. Justification for the exclusion of emotive as opposed to referential problems will be made.

23.1 Formation Rules of English.

23.11 The methods by which we can present the formation rules of a sample text can be varied, once the minimal syntactic elements have been discovered as in 7.4. (This has been remarked in 3.14, 7.42 and 7.43).

The method of presentation chosen in this paper begins by placing syntactic elements in word classes which are defined by examination of the occurrence of bound forms, that is, inflections

and word formatives. Here we deal no longer with syntactic classes but compact statements about them. (See 3.12 and 7.42).

The free forms which take no inflections are listed separately in appropriate classes which might well remain syntactic. In an unpublished supplement to "A Statistical Study of English Word Formation" by Harwood and Wright,¹ it has been shown that words which can not be classed as nouns, verbs or adjectives are quite limited.

23.12 Once these classes have been set up through study of a sample of the language, every word of a given text can be treated as a position in a sentence having so many word positions. (Contrast 7.41 where every syntactic element is a position). The formation rules would now be developed to cover the possible occurrences of words.

For example, by studying the occurrence of v₄ing and n₄o, we could record when a free form plus a bound form can be replaced by a single free form. It is clear then, that the zero element has only notational significance and is not to be considered on the same level as an inflection. (Cp. 7.44). The formation rules would also have to show when one syntactic element of a class and not another can occur. For example, it would have to contrast t^{sg} n₄o v₄s with t^{pl} n₄s v₄o.

Again, the formation rules would eliminate ambiguous word classes such as n/v etc. from a text.

Consider: Her care (n^{to}, v^{to}) for her mother; their rich (a^{to}, n^{to}) produce (n^{to}, v^{to}). The formation rules will not permit v^{to} to occur, but will have to allow that rich remains ambiguous, since it can occur elsewhere with ly or s. Some words will also be initially found ambiguous as to the inflections they possess, and again, the formation rules will be able to clarify. For example:

The wounded (v^{to}, v^{to}) animals. (Cp. 3.12).

The table of rules thus tells that in certain arrangements of certain symbols in certain positional lengths, only one word class or inflection can occur. The table will have been discovered from the sample of the language when setting up the minimal syntactic elements. (See 7.41). But it may be that they will sometimes not apply to the work of a given author. An exact measure of his variation from the standard in syntax can then be made.

23.2 Guide to a Sample Syntax of English.

Given only the constructed classes and the formation rules, an abstract sample description of English syntax can be developed systematically. The system would begin with the uses of the noun, and other word variables or constants such as v^{ing}, a^{to}, and individual pronouns, before uses of the verb, because such a verb construction

with as few other syntactic elements as possible, is the smallest structure to which we can match any contracted sentence.

If a noun or a verb is missing in a contracted sentence it can always be supplied. From the verb construction base a list of sentences which include more elements than those necessary to have a sentence at all can be developed and combinations up to any given number of positions can be considered.

This view of what constitutes a minimum English sentence may be considered arbitrary, but at least there is statistical evidence to show that the vast majority of English sentences require at least both a verb and another word unit such as a noun before it.

Structures of a longer kind could then be introduced, and very complex ones included if desired. Straight listing⁴ the formulas, of course, could be replaced by rules stated in the word language to apply to an initial set. (This might consist only of minimum n and v constructions).

The degree of sentence length and variety to be described will depend upon the purposes for which the syntax is stated. One system may wish to cover the most frequently occurring sentences in the language, and another may wish to be exhaustive. Short but infrequently occurring sentences may occur in the last but not in the first.

23.3 Uses of Syntax Systems.

23.31 If a system is required for use in a machine which will build sentences out of morphemes for the purpose of conveying referential information, then the number of positions and arrangements of the symbols should be adequate to convey any such information desired from using a list of commonly occurring morphemes.

The machine could then use a particular style of sentence construction, and it could be found convenient to eliminate other styles because of the limitation of space in the machine. A brief syntax would be better than a superfluous one.

One minimal test for its adequacy would have to be that it enabled every morpheme from the list (e.g. the first twenty thousand words of Thorndyke-Lorge)² to enter sentence patterns. Thus there would be no exclusion of the possible use of important words like though and if in the small classes. A test for superfluity could include assessment as to whether a complex sentence can be broken into two or more elementary ones of a commonly occurring kind without any loss of referential meaning value. Another useful test could be to see whether one sentence pattern is referentially equivalent to another to enable the elimination of one of them. Such a system would of course be static, and the formulas would permit only possible arrangements of the symbols according to past usage.

23.32 The machine system would not include knowledge of an emotive kind on the syntactic level. It could not deal with evocative arrangement of clauses etc. in complex sentences, nor with subtleties of non - referential meaning due to placement of sentences, use of the active or the passive form and etc. It would not be capable of representing the individual structural style of different authors.

It would however, be capable of using the values of the variables emotively as well as quite nonsensically, as no rules have so far been included to limit random selection. A Harris system is comparable, since it allows a sentence like The green rose lifted the mantelpiece. This would be sensible only in an imaginative fantasy or similar.

If we are formalizing information in a particular scientific field it is necessary to prevent what is not empirically possible from occurring. Thus the empiric laws of a field such as botany, or a sub-unit of chemistry or physics etc., have to be introduced.

It would be necessary to sub-class the members of the logical variables and provide rules for what sub-classes may combine with others, and with what logical and descriptive constants.

This sub-classing is analogous to the introduction of a theory of types as given by Russell and others. Empiric laws tell us what combinations of words are possible and what are impossible. Thus,

(1) Chairs are not self moving things would be an empiric rule and never false. It would never permit (2) The chairs are walking, but would allow (3) The chairs are small. The third sentence is a possibility (either true or false) under the rules, while the second is not. (Existence is assumed).

It is clear that if an extremely full list of rules were included, then even sentences like John is tall would either be always true as one of the empiric rules, or else always impossible. In the extreme case, no false sentences would occur.³

Obviously non-empiric data is here excluded. With new knowledge the rules may have to be altered to allow what was previously impossible to occur. A new and seemingly contradictory discovery of science will have to be incorporated.

23.33 A machine which is desired to formalize the information in a given scientific text, and test its deductions or develop them further, will require a wider range of sentence patterns than the previous. It will need at least all the commonly found structures including the syntactic equivalences and implications. In addition, like the previous machine, it will require transformation rules which are not just syntactic. Both machines would operate in a logically deductive manner, and, it is felt, be preferable to machines using symbolic logic in the way which follows for example from the work of Woodger.

23.34 F.W. Harwood has briefly pointed out in discussion that the style of analysis earlier outlined for finding the syntactic elements of a given text, may provide the means of stating transition tables between the members of the morpheme classes. For each position in a sentence formula we could list what morphemes will occur in it when the other positions are filled by other individual morphemes.

It can be added that the introduction of transition tables would be similar to the introduction of empiric rules for a scientific subject, only in this case, we would expect to find emotive as well as referential uses of words. For example consider Your hands are icy, where factual possibility is not important. Such a study, as others, would be best tackled by machine methods.

23.4 Emotive Problems.

23.41 Throughout the paper the full meaning range of the language has not been explored. Neither on the semantic nor on the syntactic level have subtleties of emotive meaning been considered other than incidentally. As the overall aim is to deal with syntax, then on this level some explanation is needed.

It can be said firstly, that it is felt artificial to separate the referential or informative aspects of a language from the emotive. They operate together. But that there are two such aspects is usually agreed upon, even if there is some incidental difference of opinion about their definitions.⁴

Now it is scarcely feasible at the present time to delve into the complexities of formalizing the emotive uses of structures (or words) when the referential or scientific uses of them are not clear. It is also more feasible to suppose that a system for a machine to handle merely scientific information, can be developed sooner than one which handles the full meaning range of a language. For example, syntactic transformations of a referential kind are much easier to extract than emotive ones.

In any case, the major point is that it is in the established structures that both referential and emotive combinations of words operate. Without knowledge of what the basic structures are, apart from their meaning ramifications, emotive analysis would come to a halt.

23.42 It should be understood that all the transformations in this paper do not claim to be anything other than referential, by definition. We could vary the kinds of transformations included by varying the definitions of the concepts of equivalence and implication. Then we could analyse a text for different knowledge. In a full study of English structure this would be necessary.

If emotive equivalences are held to be a necessary part of syntax study, then so also are referential ones, and a beginning must be made. The study of the manner in which factual data open to verification, is conveyed, can be primary.

In order to find emotive equivalences, more thorough study has to be made of contexts than appears to be required to find referential ones. Many problems about the definitions of contexts and etc. would become involved.

23.43 The facts remain however that syntactic emotive values require research. For example, particular experiential effects can be created when common structures are disturbed.

Again, there has been discussion about machine use of structures. But if it is held that a machine can use them to create actual sentences in textual form, it can not be held that it can do so by pulling the structures out of a hat.

What structure is selected does not depend only on (1) the word values it is desired to use, but also upon (2) the possibilities of what structures can follow what others. These possibilities have not yet been discovered, but could be found by using distributional methods only.

Nevertheless, that different structures of (2) having the same referential meanings, have different emotive ones is clear.

Consider

(a) When I came in I saw him.

I saw him when I came in.

(b) Tom slowly walked down.

Tom walked slowly down.

Tom walked down slowly.

Differences of emphasis and factors of rhythm and style would be involved in their textual use.

23.5 Appendix: Illustration of Basic Sentence Types and IC's.

23.51 In this brief appendix some examples of acceptable sentence structures are given. They are merely selected illustrations, although the sentence types within the first boundary are fairly well covered for present tense, when noun expansions are excluded. The line breaks occurring after groups of symbols indicate the IC units, according to the theory that an IC can possibly be specified by considering where a sentence boundary could occur within a longer sentence.

These groups can be compared with those groups marked off in some few examples of transformations, where the composition of a group is determined by the possibility of sentence re-arrangement in syntactically equivalent referential statement. Meaning analyses of such structural units could be undertaken.

The numbers at the left of the formulas indicate the number of morpheme positions in each one.

23.52 Some Sentence Types of the Statement Kind.

(2) t'pl v+o

Some break

m^lpl v+o

They come

n+(s) v+o

Men work

(Note: (s) indicates vowel change from sing.)

(3) <u>t'^{sg} v_{ts}</u>	<u>This pulls</u>
<u>m^{IsG} v_{ts}</u>	<u>She comes</u>
<u>m^l v_{ts}</u>	<u>His flies</u>
<u>m^{lpl} v_{to}</u>	<u>Their's go</u>
<u>n^{sg} v_{ts}</u>	<u>Cheese melts</u>
<u>a_{to} v_{ts}</u>	<u>Red glares</u>
<u>n_{ts} v_{to}</u>	<u>Horses race</u>
<u>n_{ts}' v_{to}</u>	<u>Cats' shine</u>
<u>tpl a_{to} v_{to}</u>	<u>The weak fall</u>
<u>tpl n₄(s) v_{to}</u>	<u>The men work</u>
<u>It v_{ts}</u>	<u>It plays</u>
<u>It BE a_{to}</u>	<u>It is strong</u>
<u>t' BE a_{to}</u>	<u>Some are thin</u>
<u>m' BE a_{to}</u>	<u>She is mean</u>
<u>m^l BE a_{to}</u>	<u>His are round</u>
<u>n₄(s) BE a_{to}</u>	<u>Mice are small</u>
<u>n^{sg} BE a_{to}</u>	<u>Coal is black</u>

(Note: m^l represents his only, because it is considered the only m^l which is a single morpheme.)

(4) t^{sg} n+o v+stpl n+s v+otpl n+s' v+ot^{sg} a+o v+stpl v+n v+otpl v+ing v+ov+ing v+sto v+o v+sn+s BE a+on+s' BE a+ov+ing BE a+ov+n BE a+oto v+o BE a+ot a+o BE a+o
1 2t^{sg} a+o BE a+oIt BE v+ingIt BE v+nm¹ BE v+ingm¹ BE v+nm⁴ BE v+ingm⁴ BE v+nm^{4sg} v+sThe man walksThese boys jumpThose cats' shineThe large breaksThe tired stopSome hoping runTalking paysTo go hurtsRoses are redLions' are hugeLifting is hardWashed are softTo lie is badThe new are freshA man is paleIt is workingIt is endedHe is playingThey are ruinedHis is twirlingHis is brokenHere starts

t' BE v+ingSome are movingt' BE v+nThat is shapedn+(s) BE v+ingSheep are lambingn+(s) BE v+nPork is bakedn^{SG} BE v+ingCoal is burningn^{SG} BE v+nIron is storeda+o BE v+ingRed is glowinga+o BE v+nSoft is liked(5) m⁴ BE v+ingYour's are tryingm⁴ BE v+nHer's is brokent^{SG} v+ing v+sThis building soarstpl v+ing+s v+oMany drawings failt^{SG} v+n v+sThe cured walkstpl n+s BE a+oThe cakes are nicetpl n+s' BE a+oSome lions' are huget v+n BE a+oThe welded are firmt^{SG} v+ing BE a+oThe reading is cleart n+o BE v+nThis dress is pleatedt n+o BE v+ingThe skirt is flowingt a+o BE v+nThe small is takent a+o BE v+ingThe kind are helpingt n+(s) BE v+nAll men are tiredt n+(s) BE v+ingThe geese are flying

<u>t n^{sg} BE v+n</u>	<u>Much cheese is aged</u>
<u>t n^{sg} BE v+ing</u>	<u>A coal is burning</u>
<u>n+s BE v+n</u>	<u>Blouses are changed</u>
<u>n+s BE v+ing</u>	<u>Plates are shining</u>
<u>n+s' BE v+n</u>	<u>Cock's are trimmed</u>
<u>n+s' BE v+ing</u>	<u>Boys' are growing</u>

Further sentence patterns can be added to those given which occur before the first sentence boundary. For example a lot of sentence types can be changed into ones using v+d. In addition, there has been an attempt to use no word formatives, but these morphemes could occur in the patterns above, and would have to be given position numbers in a syntax statement. (E.g. consider ripen, synthetic, materialize etc.) Again, some y occur only with ε_c following, and these have been ignored.

The given sentence types occurring before the first sentence boundary can be taken as minimum. Noun and verb expansions will arise below.

23.53 Sentence types which run beyond the first sentence boundary can next be developed. The examples below merely serve to show other sentence boundaries and do not exhaust combinatorial possibilities. The brackets show what can be included in a column if desired, without necessitating a new sentence boundary. In order to find out the values

of IC units for any one sentence type, it would be necessary to hold a value constant in every IC column except one. The values of the excepted column would then be examined and listed. (For fuller explanation of such procedure see 7.4).

A		D	C		D		E	F		Etc.	
<u>t^{sg} n+o (a+ly) v+s (p)</u> b	1	<u>to</u>	3	<u>t (d) (a+o) (a+o) n+o</u>	6	<u>to v+o</u>	13	<u>n+s</u>	17	<u>c z</u> 21	
<u>tp^l n+s (ē v+ing a+o) v+o (p)</u> b	2	<u>atly</u>	4	<u>t (d) (n+o) (n+o) n+o</u>	7	that who } which } <u>v+o^s</u> 14	<u>t n+s^o</u> 18				
		<u>as</u>	5	<u>t (d) (a+o) (a+o) (a+o) n+s</u>	8						
				<u>t (d) (n+o) (n+o) (n+o) n+s</u>	9						
				<u>a+o (v+ing) (n+o) n+s</u>	10						
				<u>d a+o (v+ing) (n+o) n+s</u>	11						
				<u>t (a+o) n+o o' t (a+o) n+o</u>	12						
				And so on with other expressions.		of		of			
						<u>p n+s</u> 15		<u>p n+s</u> 19		that	
						of		of		which } <u>nc a+o</u> 22	
						<u>p t n+o^s</u> 16		<u>p t n+s^o</u> 20			who }

Note: H indicates those a which combine with transitive verbs.

Any formula in any column combines with any sentence created from use of the previous columns, except where the horizontal line occurs. This just shows that the formulas below combine only with one another, and the ones above do the same. Any formula arising from either side of the line can still combine with any arising from the previous columns. Other formulas are obviously possible, but it is felt simplicity for illustration is required.

- Thus: (a) The man chops / the wood / to help / the women / although **z**
 (b) The man chops / the wood / from the bush / with an axe / that
is sharp.

It is also obvious that the verbs need subdividing and greater refinement of word classification is required.

23.54 A few transformations remain to be given. Capital letters indicate the columns in 23.53.

- | | | | |
|---|---|---|---|
| A | B | B | A |
|---|---|---|---|
1. t^{SE} nto vts / atly = atly / t^{SE} nto vts
The man works quickly = Quickly the man works
 (atly / vts / t nto, Quickly / works / the man, subdivides A)
- | | | | |
|---|---|---|---|
| A | B | B | A |
|---|---|---|---|
2. t^{SE} nto vts / d = d / t^{SE} nto vts
The man works here = Here the man works
 (d / vts / t nto, Here / works / the man, again subdivides A)
- | | | | | |
|---|---|---|----------------|----------------|
| A | C | C | A _I | A ₂ |
|---|---|---|----------------|----------------|
3. t^{SE} nto vts / t^{SE} ato ato nto = t^{SE} ato ato nto / Be vtn / by t^{SE} nto
The man works the rich brown wood = The rich brown wood is worked
by the man

4. $\frac{\overset{A}{t^{sg}} \overset{C}{n\dot{o}} \overset{D}{v\dot{t}s} / \overset{C}{t^{sg}} \overset{D}{a\dot{o}} \overset{D}{a\dot{o}} \overset{D}{n\dot{o}} / (\overset{D}{t\dot{o}} \overset{D}{v\dot{t}\dot{o}})}{1 \quad 2}$
 (standing
The man wants the rich dark wood (to stand
- = $\frac{\overset{C}{t^{sg}} \overset{A^1}{a\dot{o}} \overset{A^1}{a\dot{o}} \overset{D}{n\dot{o}} / \overset{A^1}{Be} \overset{D}{v\dot{t}n} / \overset{D}{v\dot{t}n} / \overset{A^2}{p} \overset{A^2}{t^{sg}} \overset{A^2}{n\dot{o}}}{2 \quad 1 \quad 2 \quad 1}$
 (standing
 = The rich dark wood is wanted (to stand by the man

5. $\frac{\overset{A}{t^{sg}} \overset{C}{n\dot{o}} \overset{D}{v\dot{t}s} / \overset{C}{t^{sg}} \overset{D}{n\dot{o}} / \overset{D}{p} \overset{D}{t^{sg}} \overset{D}{n\dot{o}}}{1 \quad 2 \quad 3}$
The man works the wood with the plane
- = $\frac{\overset{C}{t^{sg}} \overset{A^1}{n\dot{o}} / \overset{A^1}{BE} \overset{D}{v\dot{t}n} / \overset{A^2}{p} \overset{A^2}{t^{sg}} \overset{A^2}{n\dot{o}} / \overset{A^2}{p} \overset{A^2}{t^{sg}} \overset{A^2}{n\dot{o}}}{2 \quad 3 \quad 1}$
 = The wood is worked with the plane by the man

6. $\frac{\overset{A}{t^{sg}} \overset{C}{n\dot{o}} \overset{D}{v\dot{t}s} / \overset{C}{t^{sg}} \overset{D}{n\dot{o}} / \overset{D}{v\dot{t}ing} / \overset{E}{t^{sg}} \overset{E}{n\dot{o}}}{1 \quad 2 \quad 3}$
 to touch/
The man wants/ the wood/touching/the floor
- = $\frac{\overset{C}{t^{sg}} \overset{A^1}{n\dot{o}} / \overset{A^1}{Be} \overset{A^2}{v\dot{t}n} / \overset{A^2}{p} \overset{A^2}{t^{sg}} \overset{A^2}{n\dot{o}} / \overset{D}{v\dot{t}ing} / \overset{E}{t} \overset{E}{n\dot{o}}}{2 \quad 1 \quad 3}$
 to touch
 = The wood is wanted by the man touching the floor

$$7. \frac{\overset{A}{t^{SG} n\downarrow o} \underset{1}{v\uparrow s} / \overset{C}{t^{SG} n\downarrow o} \underset{2}{/ p} \overset{D}{t^{SG} n\downarrow o} \underset{3}{/ p} \overset{E}{t^{SG} n\downarrow o} \underset{4}{/ p}}{}$$

The man works the wood with the plane in the shed

$$\bullet \frac{\overset{C}{t^{SG} n\downarrow o} \underset{2}{/ BE} \overset{A^1}{v\uparrow n} \underset{1}{/ p} \overset{A^2}{t^{SG} n\downarrow o} \underset{1}{/ p} \overset{D}{t^{SG} n\downarrow o} \underset{3}{/ p} \overset{E}{t^{SG} n\downarrow o} \underset{4}{/ p}}{}$$

■ The wood is worked by the man with the plane in the shed.

$$8. \frac{\overset{A}{t^{SG} n\downarrow o} \underset{1}{v\uparrow s} / \overset{C}{t^{SG} n\downarrow o} \underset{2}{/ to} \overset{D}{v\uparrow o} \underset{3}{/ t^{SG} n\downarrow o} \underset{3}{/ c} \overset{E}{it} \underset{3}{BE} \underset{3}{a\downarrow o}}{}$$

The man wants the wood to touch the floor if it is ready.

$$\bullet \frac{\overset{F}{c} \underset{3}{it} \underset{3}{BE} \underset{3}{a\downarrow o} \underset{3}{/ t^{SG} n\downarrow o} \underset{2}{/ BE} \underset{2}{v\uparrow n} \underset{2}{/ p} \overset{A^1}{t^{SG} n\downarrow o} \underset{1}{/ to} \underset{1}{v\uparrow o} \underset{1}{/ t^{SG} n\downarrow o} \underset{3}{/ p}}{}$$

■ If it is ready, the wood is wanted by the man to touch the floor.

More research along these lines would very likely be fruitful.

Meanwhile, it is hoped to draw attention to the importance of the cuts.

(5, 6, 7, and 8 have other equivalences. E.g. 5. The wood is worked by the man with the plane.)

¹ Harwood, F.W., and Uright, Alison M., "Statistical Study of English Word Formation", Language, 32 (1956), p.260 foll.

- ² Thorndike, E.L., and Lorge, I., The Teacher's Word Book of 30,000 Words (New York, Bureau of Publications, Teacher's College, Columbia University, 1944).
- ³ (a) The views here may be compared with those expressed in Lewis, C.I., and Langford, C.H., Symbolic Logic, (New York, The Century Co., 1932) p.90. It appears to us that nonsensical sentences are to be identified with impossible ones under the rules, or else possible ones which are false and seem like nonsense. The second are to be differentiated from the first.
- (b) See also Russell, Bertrand, Introduction to Mathematical Philosophy (London, G. Allen & Unwin, 1919) p.135-p.137, p.155, p.162; and his collected essays, Logic and Knowledge (London, G. Allen & Unwin, 1956) p.75.
- ⁴ See Black, Max, Language and Philosophy, (New York, Cornell University Press, 1949) Chapter IX.